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ABSTRACT

This competency-based basic course outline is designed for a two-year secondary program in computer maintenance technology. The first year is devoted to basic electricity and electronics, the second to the troubleshooting, maintenance, and service of microcomputers. (The repair section is based upon the Apple II computer, disc drive, monitor, and printer.) This outline includes only the basic skills and technical information to be taught and should be supplemented with other complementary and necessary areas of related instruction. Ten major blocks of instruction cover orientation, basic skills, direct current circuits, alternating current circuits, semiconductor theory, digital electronics electronic systems, electronic circuits, microcomputer repair, and entrepreneurship. Each major block is comprised of two to seven minor blocks, which are composed of 1 to 11 tasks. For each task are provided the aim and a course overview that includes information and task detail (an outline of related knowledge and listing of task detail), suggestions for teaching, and recommended references and aids. A bibliography is followed by information for the vocational industrial teacher on developing a functional course of study. (YLB)

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COMPUTER MAINTENANCE TECHNOLOGY

SUGGESTED BASIC COURSE OUTLINE

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A
SUGGESTED BASIC COURSE OUTLINE
FOR

COMPUTER MAINTENANCE TECHNOLOGY

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FOREWORD

This course outline is one of a series of basic course outlines for teaching vocational industrial subjects in the secondary school. Each basic course outline is developed by utilizing an advisory committee consisting of outstanding teachers of the occupational trade, and representatives from industry, whose expertise is used to identify the competencies and related and technical information that is essential to the occupational trade, and for validation of the material. This competency based basic course outline was developed under the supervision of Vocational Industrial Education Staff, Vocational Instructional Services, Texas A&M University through the cooperation and approval of the Texas Education Agency.

The purpose of this basic course outline is:

1. To assist the beginning teacher in selecting the occupational skills and related and technical information and provide a basis upon which the teacher can progressively build a functional course of study in accordance with the training needs of the students, the local community, and industry.
2. To assist the teacher in identifying and correlating pertinent technical information.
3. To assist the teacher in determining the time needed to teach each lesson and a basis for the proration of time in the total program.
4. To assist the teacher in the selection of appropriate methods, teaching aids, and references, and supply the teacher with the sources of information, films, references, and aids.
5. To assist the teacher in the development of/or selection of appropriate instructional sheets or materials.
6. To assist in the improvement of communications between the teacher and the student through the use of stated behavorial objectives(Aims) for each task and to corresponding technical information.
7. To provide interested educational and industrial groups and individuals with information regarding the scope, content, methods and techniques of trade preparatory instruction.
8. To provide local school administrators and boards of education with information that may assist them in selecting and inaugurating trade preparatory programs best suited to the needs of their student bodies.

This outline includes only the basic skills and technical information to be taught and should be supplemented with the other complementary and necessary areas of related instruction. Experiences should be provided for the development of desirable attitudes and appreciations.

PURPOSE

The purpose of vocational industrial education is to develop basic manipulative skills, safety judgments, proper work habits, desirable attitudes and appreciations for the purpose of fitting young persons for initial employment in industrial occupations and of upgrading or retraining workers employed in industry.

Training is provided through practical shop and/or laboratory experiences and other closely related school activities. The local school provides the shops or laboratories, tools, equipment and materials which are comparable to those used in industry. Each student enrolled receives three hours of instruction each day which is centered around the performance of useful or productive jobs and activities and taught by a teacher who is experienced and competent in the occupation.

COURSE OBJECTIVES

This outline is designed with the intention of providing students with an opportunity to develop skills, knowledge, attitudes, and leadership, after having the instruction provided by a competent

The students will be able to:

1. Perform the basic manipulative skills involved in the occupation.
2. Make application and use of the underlying theories, technical information, and related occupational information to assure sound judgments, decisions and proper procedures involved in the occupation.
3. Appreciate and respect the employer-employee relationship, and have an awareness of the necessity of delivering worthy service for value received.
4. Develop a sense of personal integrity and confidence in their ability to earn their rightful place in the community.
5. Practice those qualities of citizenship which will lead the way toward a happy and productive life.
6. Gain employment in the occupation for which training was given.

INTRODUCTORY STATEMENT

This suggested basic course outline is designed for a two-year program in computer maintenance technology. The first year is devoted to basic electricity and electronics. The second year is devoted to the troubleshooting, maintenance, and service of microcomputers.

For the most part, the section on the repair of microcomputers is based upon the Apple II computer, disc drive, monitor, and printer. This was due to the availability of service manuals made available for reference use.

It is not the intent of this basic course outline to attempt to cover each and every type of test equipment or microcomputer on the market. However, most of the material covered is pertinent and applicable to all computers and may be applied as needed. More specific information can be obtained through contact with the individual computer manufacturing company. In many cases this can be accomplished by the instructor attending the computer school for training and taking this information back to the students.

Changes in methods of computer repair have simplified identifying the problem. By having an agreement with the manufacturer, damaged boards may be returned for repair and sent back for reuse. This provides a fast repair at less cost than by having a technician repair the board at the place of business.

ACKNOWLEDGEMENT

A sincere note of gratitude to Mr. James E. Hodges, electronics and microcomputer maintenance instructor at Klein Forest High School in Houston, who found time in his busy schedule to assist in the development and review of the Basic Course Outline for Computer Maintenance Technology. It was through his efforts and agreement with the Apple Computers, Inc., whose training school he attended, that the Apple Computers, Inc., made available as reference materials the manuals and video tapes used in the service and repair of Apple Computers.

Appreciation is also extended to others who have provided direction and assistance in making this publication possible. Especially helpful were the following:

Mr. Joe Martinez, Curriculum Coordinator and the Computer Maintenance Technology staff at T.S.T.I., Harlingen, Texas.

Mr. Jack Mullins, Field Manager, ARC Automation.

The companies who responded to the survey sent out to identify the job entry specifications for technicians entering this field.

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MAJOR BLOCK I

ORIENTATION

TASK: 1. Introduction to Pre-Employment Class

AIM: The student will be able to describe operating procedures of the computer maintenance technology classroom and lab and the skills and competencies they will develop.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Course Overview	Related Knowledge		
	I. Introduction	Place on chalkboard:	
	A. Teacher	course title	
	B. Students	instructor's name	
	C. Course	Have students introduce themselves	
	II. Philosophy of vocational education	Passout: Course philosophy and objectives	
	III. Instructor's philosophy		
	IV. Course description	Provide: Course description, method of instruction, job description	Instructor prepared
	A. Course objectives		
	B. Scope and content		
	1. First year	Discuss with class	
	2. Second year		
	C. Method of instruction	Show samples	Instructor prepared
	1. Lessons		
	2. Assignments		
	3. Tests		
	4. Projects		
	D. Supplementary instruction	Discuss: Types of films, field trips, and guest speakers	
	1. Films		
	2. Field trips		
	3. Guest speakers		
	E. Testing procedure		
	1. Classroom		
	2. Laboratory		
	G. Course requirements	Discuss requirements of the course	Local school handbook for students
	H. Credits and certificates		
	1. Competency profile	Discuss the credits to be received, competency profile, and certificate of completion	Ref. A, "Competency Profile for Computer Maintenance Technology," Vocational Instructional Services, Texas A&M University, F.E. Box
	2. Certificate of completion		

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Course Overview (continued)	Related Knowledge (cont'd)		182, College Station, TX 77843 Ref. B, "Certificate of Completion", Vocational Instructional Services, Texas A&M University, F.E. Box 182, College Station, TX 77843

MAJOR BLOCK I

ORIENTATION

TASK: 2. Identify School and Shop Policies and Procedures

AIM: The student will be able to identify policies and procedures and participate in classroom and shop activities within the framework of school and shop regulations.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Course Overview	Related Knowledge		
	I. School policies	Passout: Rules and regulations	Local/state school policies
	A. Schedules	Discuss with students	
	B. Attendance and tardies	Questions and answers	
	C. Conduct and dress		
	D. Fire drills		
	E. Makeup work		
	F. Absences		
	G. Disciplinary action		
	H. Special activities		
	1. Field trips		
	2. Leadership meets		
	3. UIL activities		
	I. Insurance		
	II. Shop policies	Passout: Rules and regulations of classroom and lab	Instructor prepared
	A. Classroom procedures		
	1. Textbooks	Discuss policies	
	2. Reference materials		
	3. Assignments		
	4. Notebooks, workbooks, and lab manuals		
	5. Tests		
	6. Classroom ethics		
	B. Laboratory	Tour lab facilities	Ref. C. Handbook For Vocational Industrial Education Shop Teachers, Vocational Instructional Services, Texas A&M University, F. E. Box 182, College Station, TX 77843
	1. Safety glasses		
	2. Behavior	Passout: Private physician card, and parental permission forms	
	3. Work stations		
	4. Equipment	Discuss each and have student fill them out	
	5. Duty assignments		
	6. Release forms		
	7. Tool room procedure		
	8. Personal tools		

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Course Overview (continued)	Related Knowledge (cont'd) III. Outside activities A. Field trips B. Leadership C. Fund raising		Ref. D, Safety For The Industrial Student, Vocational Instructional Services, Texas A&M University, F.E. Box 182, College Station, TX 77843

MAJOR BLOCK I
ORIENTATION

TASK: 1. History of Electronics
AIM: The student will be able to describe the evolution of electronics in communication and computation.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Job Orientation	Related Knowledge		
	I. Need for communication	Discuss	Ref. #1, Cannon, Don L. and Luecke, Understanding Communications Systems, Texas Instruments Learning Center, P. O. Box 225012 MS 54, Dallas, TX 75265
	A. Social interaction		
	B. Convey information		
	C. Barter and trade	Oral questions	
	D. Record keeping		
	II. Evolution of communication		
	A. Speech		
	1. Vocal sounds developed in words		Ref. #2, The World Almanac and Book of Facts, Newspaper Enterprise Association, Inc., 230 Park Ave, NY, NY 10017
	2. Words developed into language		
	B. Symbolic speech		
	1. Drawings in caves		
	2. Hand sign language		
	3. Light signals		
	4. Smoke signals		
	C. Early written language	Show relationship between education and communication	
	1. Egyptian Hieroglyphics		
	2. Babylonian Cuneiform		
	3. Semite Alphabet		
	D. Advances in communication		
	1. Block printing - ancient Asia		
	2. Gutenberg press - 1440		
	3. Cylindrical press - 1814	List on chalkboard	
	4. Telegraph - 1837		
	5. Transatlantic cable - 1858		
	6. Telephone - 1876		
	7. Wireless telegraph - 1896		
	8. Radio - 1895		
	9. Television - 1923		
	10. Satellites - 1957		

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Job Orientation	Related Knowledge (cont'd)		
(continued)	III. Early computers		Ref. #3, Walker, Roger S., Understanding Computer Science, Texas Instruments Learning Center, P.O. Box 225012 MS 54, Dallas, TX 75265
	A. Abacus 1. 4,000 years ago 2. Asian countries 3. Fast accurate 4. Still in use		
	B. Mechanical calculation		
	1. John Napier - 1617 a. Published paper b. Led to development of slide rule 2. Blaise Pascal - 1642 a. Adding machine b. Wheels and gears 3. Late 1600's - Gottfried Liebnitz a. Advanced calculator b. Four function plus square roots	Demonstrate	
	C. Punched cards 1. Early 1800's - Joseph Tacquard a. First punched card b. Loom instructions 2. 1835 - Charles Babbage a. Analytical engine b. Mathematical computer c. Punched card program d. Conditional transfer loops e. Principles still used today	Explain function	

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Job Orientation	Related Knowledge (cont'd)		
(continued)	3. 1890's - Herman Holerith		
	a. IBM card		
	b. Coded puching sequence	Oral or written quiz	
	c. First electrical machine		

MAJOR BLOCK I ORIENTATION	TASK: 2. Electro-Mechanical to Electronic Computers AIM: The student will be able to describe how computers have evolved during this century.		
MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Job Orientation	I. Electro-mechanical A. 1944 - Howard Aiken 1. Harvard University 2. First electro-mechanical computer B. Mark I 1. 51 feet long - 8 feet high 2. Paper tape instructions 3. Punched card input 4. Typed card record 5. Three second multiplier C. 1947 - Mark II 1. 1/4 second multiplier 2. 12 times faster II. Electronic computers A. 1946 - ENIAC 1. University of Pennsylvania 2. Eckert and Mauchly 3. First electronic digital computer 4. Used vacuum tubes. 5. 2.8 millisecond multiplier B. 1946 - Von Neumann 1. Parallel transfer idea 2. Stored program idea C. 1950 - UNIVAC I 1. First mass-produced electronic computer 2. Same group as ENIAC 3. Vacuum tubes	Discussion Lecture Question List on chalkboard	Ref. #4, Cannon, D.L., and Luecke, Gerald, Understanding Microprocessors, Texas Instruments Learning Center, P.O. Box 225012 MS 54, Dallas, TX 75265

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Job Orientation	**Related Knowledge (cont'd)**		
(continued)	D. Since 1950		
	1. 1958 - Jack Kilby, Texas Instruments - integrated circuit		
	2. 1971 One-chip calculator		
	3. 1972 4-bit microcomputer on a chip		
	4. 1976 16-bit microprocessor		
	5. 1977 16-bit on a chip	Oral quiz	

MAJOR BLOCK I	
ORIENTATION	TASK: 3. Identify the Opportunities in Computer Maintenance Technology AIM: The student will be able to identify the educational background, required skills, training background, and opportunities needed and available in the field of computer maintenance.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Job Orientation	**Related Knowledge**		
	I. Broad in scope	Explanation	
	A. Center of modern industry		
	B. Applications	Discussion	
	1. Robotics	Hand out information sheet	Information sheet: instructor prepared
	2. Automotive industry		
	3. Business field		
	4. Medicine		
	5. Home appliances		
	II. Level of proficiency	Guest speakers: "Job Market for Computer Maintenance Technicians"	Representative from computer science field or personnel director
	A. Semiskilled		
	1. Assembly line worker		
	2. Parts room		
	3. Requires little education		
	B. Skilled		
	1. Electronic assembly		
	2. Product manufacturing		
	3. Requires more education and training		
	C. Technical		
	1. Build and test devices		
	2. Install and maintain equipment		
	3. Troubleshoot and repair		
	4. Electronic technicians		
	5. Computer programmers		
	6. Engineers' assistants		
	7. Technical school, community or junior college required		

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Job Orientation (continued)	Related Knowledge (cont'd) D. Professional 1. Engineers 2. Theory and design 3. Research 4. Product improvement 5. Bachelor's degree or higher required III. Educational requirements A. Factory trained B. Certificate programs C. Associate Arts degree D. Baccalaureate or higher IV. Job opportunities A. Rapid expanding field B. Computer equipment manufacturers C. Computer installation companies D. Computer maintenance firms E. Possible self employment		

MAJOR BLOCK I
ORIENTATION

TASK: 1. Develop Safe Work Habits
AIM: The student will be able to identify safe working practices, demonstrate skills in working safely, and apply safe working practices as relate to the trade.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Safety	Related Knowledge		
	I. Accident statistics A. Injured B. Deaths II. Results of accidents A. Worker 1. Lost income 2. Reduced earning ability 3. Pain and suffering B. Employer 1. Production loss 2. Property damage 3. High insurance rate C. Public 1. Higher priced goods 2. Lost tax revenue 3. Support welfare assistance	Reading assignment Discuss with students: 1. Importance of safety 2. Safety attitude	VIS Ref. D
	III. Safety awareness A. Accident causes B. Types of accidents C. Importance of safety	Slides: Prepare students Show slides Read and discuss script with each slide	Slides: Group programmed instruction Accident Causes, Slides, color, script, Bureau of Occupational Safety - 3-224, U.S. Department of Labor, Washington, D.C. 20210 Free, borrower pays return postage (Book two months in advance)
	IV. General safety A. Safety glasses B. Dress/grooming	Guest speaker	Guest speaker: optometrist, safety engineer, school nurse, doctor, local fire department

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Safety (continued)	Related Knowledge (cont'd)		
	C. Housekeeping 1. Materials 2. Inflammables 3. Caustics 4. Tools 5. Equipment	Passout: 1. General safety rules 2. Fire safety procedures 3. Use of fire extinguishers 4. Safety rules for tools-hand /power	
	D. Handicap 1. Under medication 2. Injury 3. Physical E. Handling materials/ equipment	Oral quiz Written safety test: Suggestion: not less than 50 questions. Student required to pass with 95% correct answers	Safety test: instructor prepared
	V. Attitude and conduct A. Attentive; alert; cooperative B. Respect for safety of self; others C. Safety awareness D. Grooming 1. Dress 2. Personal hygiene		
	VI. Color coding A. Importance B. Traffic lanes C. Housekeeping D. Machine and parts E. First aid F. Safety; caution	Passout: pamphlets Discuss color dynamics Explain color safety codes	Pamphlets: DuPont Safety Color Code, Pittsburg Paints Color Dynamics
	VII. Tools - hand/power A. Selection/use B. Maintenance C. Safety		
	VIII. Fire safety A. Types of fires B. Causes of fire C. Extinguishers 1. Types		

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Safety (continued)	Related Knowledge (cont'd) 2. Location 3. Proper use D. Building exits E. Fire drill procedure IX. Compressed air A. Compressors B. Pressure hoses/nozzles C. Proper use/safety X. Electrical safety A. Grounding 1. Tools/equipment 2. Work tables 3. Wet floors B. Extension cords 1. Proper use/care 2. Inspection C. Overloads D. Conductor/insulators E. Rescue procedures F. First aid XI. Miscellaneous A. Eye and ear protection B. Volatile materials C. Emergency procedures		

MAJOR BLOCK I ORIENTATION	TASK: 2. Electric Shock and Rescue AIM: The student will be able to relate the dangerous aspects of working with electricity and describe rescue procedures of a shock victim.		
MINOR BLOCK C	**INFORMATION & TASK DETAIL**	**SUGGESTIONS FOR TEACHING**	**REFERENCES & AIDS**
Safety	Related Knowledge		
	I. Electrical accidents in industry	Discussion	VIS Ref. D
	A. Over 1,000 deaths a year		
	B. Thousands more injured		
	II. Causes		
	A. Unsafe conditions		
	1. Damaged extension cords		
	2. Splices in drop cords		
	3. Poor wiring		
	4. Short circuit in tools	Display damaged cords	
	5. Others		
	B. Unsafe acts		
	1. Abuse of electrical equipment		
	2. Overloading circuits		
	3. Working on live circuits		
	4. Removing grounding prong	Demonstrate safe gear	
	5. Not using safety gear		
	6. Others		
	III. Shocking facts		
	A. Voltage not as important as current		
	1. Spark plug wire in car has 20,000 volts but is not deadly		
	2. Ampers is rate of current flow		
	3. House current of 120 volts can kill depending on:		
	a. Natural resistance of the individual - people vary		

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Safety	**Related Knowledge (cont'd)**		
(continued)	b. Path of current through body		
	c. Length of time		
	d. Physical and mental condition		
	e. Phase of heart cycle		
	B. Physical circumstances		
	1. Dry skin + dry wood floor = high resistance		
	2. Wet skin + wet ground = low resistance		
	3. Low resistance allows greater amperage		
	4. Even 50 volt circuit can be dangerous	Point out dangers of TV sets, etc.	
	C. Rescue procedures		
	1. Do not touch victim with hands		
	2. Turn off circuit if possible		
	3. If not, use long dry stick to remove victim from circuit	Demonstrate	
	4. Give artificial respiration if not breathing		
	5. Send for help		

MAJOR BLOCK I
ORIENTATION

TASK: 3. Fire Prevention and Control
AIM: The student will be able to describe various types of fires and select the proper extinguisher for their control.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Safety	Related Knowledge		
	I. Things necessary for fire	Reading assignment	VIS Ref. D
	A. Fuel	Discuss	
	B. Oxygen		
	C. Heat		
	II. Classes of fire	Use chalkboard	
	A. Class A - wood, paper, cloth	Passout: information sheet	Instructor prepared
	B. Class B - flammable liquids		
	C. Class C - electrical equipment		
	D. Class D - combustible metals		
	III. Fire extinguishers and symbols		
	A. Type A extinguisher		
	1. Symbol - A in green triange		
	2. For class A fires		
	B. Type B		
	1. Symbol - B in red square		
	2. For class B fires	Demonstrate	
	C. Type C		
	1. Symbol - C in blue circle		
	2. For class C fires		
	D. Type D		
	1. Symbol - D in yellow star		
	2. For class D fires		
	IV. Fire safety rules		
	A. Flammable liquids		
	1. Metal containers		
	2. Properly stored		
	B. Soldering		
	C. Spontaneous combustion		

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Safety	Related Knowledge (cont'd)		
(continued)	D. Ventilation		
	E. Static electricity		
	F. Fire extinguishers		
	G. Housekeeping	Conduct fire safety inspection	
	H. Fire hazard	Safety test	
	I. Smoking		

MAJOR BLOCK I ORIENTATION	TASK: 1. Identify the Place of VICA in the Structure of Vocational Education AIM: The student will be able to identify VICA as an integral part of vocational education and to recognize the leadership opportunities inherent to the organization.		
MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
VICA	Related Knowledge		
	I. Background of the organization: Vocational Industrial Clubs of America	Explain, briefly, the factors that led to the creation of VIC (later VICA) Explain the organization's place in vocational industrial education Present certain statistics on membership growth, increase in number of chapters, transition from state to national organization	Sup. Ref. E, VICA Handbook Vocational Industrial Clubs of America, Inc., 105 N. Virginia Ave., Falls Church VA 22046
	II. Organization of VICA	Show slides: Tell students what to look for in presentation Show slide presentation Discuss presentation	Slides: VICA, Developing Leaders for Tommorrow's Industry, Vocational Instructional Services, F.E. Box 182, Texas A&M University, College Station, TX 77843
		Explain organization aspects: local chapter, district, state and national affiliations	Sup. Ref. E
		Outline administrative structure: local advisor, superintendent, area supervisor, state executive secretary, and national executive secretary	
		Transparency on organizational structure of VICA organization	Instructor prepared

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
VICA (continued)	Related Knowledge (cont'd)		
	III. Opportunities for developing leadership abilities A. Serving as officer of local, area, or state chapter B. Attend leadership training conferences at area, state, or national level	Leadership skills learned while: (a) Serving as chairperson of committee, or committees Guest speaker	Sup. Ref. E Guest speaker: Former VICA student: district officer; or second year VICA student from another club or town club
	IV. Participate in local chapter activities A. Competitive activities B. Social activities C. Service activities D. Open house for public school week E. Parents night F. Initiation banquet G. Assembly program	Explain and discuss chapter activities with students Plan year's activities Show slides of previous year's activities	Slides or photo of previous club activities Suggested plan for year's activities Sup. Ref. F, Texas National VICA Competitive Activities Guide, VIS, F.E. Box 182, Texas A&M University, College Station, TX 77843, 1979
	V. Participate in area meeting and state convention A. Chapter events B. Speed-skill contest C. Technical information D. Student selected jobs E. Individual events	Explain and discuss areas of competition at area and state level Discuss students' preparation for the events Refer to previous winners	Sup. Ref. G, VICA U.S. Skill Olympics Regulations, Vocational Industrial Clubs of America Inc., 105 N. Virginia Ave., Falls Church, VA 22046

MAJOR BLOCK I
ORIENTATION

TASK: 2. Local Club Organization
AIM: The student will know the structure, functions and goals of the local VICA organization and will be given the opportunity to participate as an officer, chairperson or assisting member.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
VICA	Related Knowledge		
	I. Membership drive A. Student awareness B. Collection of dues C. Organization report D. Initiation ceremony	Display of VICA posters and signs	Student - teacher prepared VICA signs Sup. Ref. H, VICA Initiation Ritual, VIS, F.E. Box 182, Texas A&M University, College Station, TX 77843
	II. Election of officers A. Duties of officers B. Qualifications C. Nomination of candidates D. Voting E. Installation of officers	Explain duties and responsibilities of officers Explain procedure for nomination of officers Explain and review installation of officers	Sup. Ref. E Instructor prepared: nomination forms, voting ballots, information sheet on qualifications
	III. Planning program A. Meetings 1. Business 2. Social meetings 3. Dates B. Social activities 1. Family banquet 2. Dances C. Service activities D. Competitive activities 1. Local 2. Area 3. State E. Public relations	Discuss plans for year Set up meetings Set up committees	Sup. Ref. I, Official Officer Installation, VIS, F.E. Box 182, Texas A&M University, College Station, TX 77843 Instructor - student prepared listing of possible club activities

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
VICA (continued)	Task Detail 1. Nomination of officer candidates 2. Election of officers 3. Installation of officers 4. Students design VICA posters 5. Collection of dues 6. Initiation day and ceremony 7. Plan program	Review qualifications of officers elect Review duties and responsibilities Review election procedures Review and rehearse installation procedure Assignment on installation ceremony Review school policy on hanging posters and types of posters Review proceedings for initiation ceremony	Nomination forms Election ballots

MAJOR BLOCK I ORIENTATION	TASK: 3. Parliamentary Procedure AIM: The student will obtain a basic knowledge of parliamentary practices through a compehensive study of the basic rules of parliamentary procedure and by applying that knowledge through participation in an active club.		
MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
VICA	Related Knowledge		
	I. Importance of parliamentary procedure A. Local club B. Civic organization C. Business firms	Assigned reading Assignment as pertains to rule (chapter's)	Sup. Ref. J, *Parliamentary Guide for Vocational Industrial Clubs of America,* Gray, Jarrell D., VIS, F.E. Box 182, College Station, TX 77843
	II. Application of parliamentary procedure A. Conduct business B. Competition	Discuss importance of having organized controlled meetings	Sup. Ref. K, *Parliamentary Procedure Workbook*, VIS, F.E. Box 182, College Station, TX 77843
		Show filmstrip Tell students what to look for in filmstrip Discuss filmstrip Test over filmstrip	Filmstrip: *Parliamentary Procedure in Action*, Parts I, II, III, Educational Film Strips, Box 289, Huntsville, TX 77340
		Guest speaker	Guest speaker: Professional parliamentarian who is obtained by city government to preside at meetings
	Task Detail		
	Gain knowledge and skill through a study of the basic rules; practice the application of the rules in an active situation; and participate in competition on area, state, and national level	Assign each chapter to be covered Explain and discuss chapter Ask questions Assign practice problems Test Application at club meetings and contest	

MAJOR BLOCK I ORIENTATION	TASK: 1. Arithmetic and Algebra Review AIM: The student will be able to manipulate and solve algebraic equations necessary for finding unknown quantities in electronics.

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Mathematics	Related Knowledge		
	I. Arithmetic review	Discussion	Ref. #5, Barker, Forrest I., Wheeler, Gershon J., Mathematics for Electronics, Addison-Wesley Publishing Company, Inc., Reading, MA 01867
	A. Addition	State rules for each	
	1. Whole numbers	Use chalkboard	
	2. Fractions	Work problems	
	3. Mixed numbers		
	4. Decimals		
	B. Subtraction		
	1. Whole numbers		
	2. Fractions		
	3. Mixed numbers		
	4. Decimals		
	C. Division	Student work problems	
	1. Whole numbers		
	2. Fractions		
	3. Mixed numbers		
	4. Decimals		
	D. Multiplication		
	1. Whole numbers		
	2. Fractions		
	3. Mixed numbers	Review	
	4. Decimals	Quiz	
	II. Algebra review	Definitions	
	A. Literal numbers		
	1. Subscript		
	2. Prime notation		
	a. Double prime	Chalkboard illustrations	
	b. Triple prime		
	B. Algebraic expression		
	1. Terms		
	2. Algebraic sum		
	3. Coefficients		

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Mathematics	**Related Knowledge** (cont'd)		
(continued)	4. Fractions		
	a. Numerator		
	b. Denominator		
	C. Equations		
	1. Identical equations		
	2. Conditional equations		
	III. Manipulations	Work problems	
	A. Equality must be maintained		
	B. Unknown factor		
	C. Unknown divisor		
	D. Unknown term		
	E. Combined manipulations	Demonstrate	
	F. Checking solutions		
	IV. Writing equations		
	A. Makes a statement		
	B. Algebraic language		
	1. Word by word		
	2. Idioms		
	C. Proportional relationships		
	1. Inversely proportional		
	2. Directly proportional		
	V. Formulas	Work problems	
	A. Ohm's Law	Quiz	
	B. Kirchhoff's Law		
	Task Detail		
	Instructor prepared assignment sheet		

MAJOR BLOCK I

ORIENTATION

TASK: 2. Scientific Notation

AIM: The student will be able to use scientific notation in solving mathematical problems encountered in electronics.

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Mathematics	Related Knowledge		
	I. Purpose of scientific notation	Discussion	Ref. #6, Oliva, Ralph A., Dale, Charles W., Basic Electricity and DC Circuits, Texas Instruments Learning Center, P.O. Box 225012 MS 54, Dallas, TX 75265
	A. Working with very large numbers	Give examples	
	B. Working with very small numbers		
	C. Metrix prefixes		
	II. Components		
	A. Base number		
	B. Power or exponent		
	III. Powers of Ten Rule		
	A. Digit, point, digit, digit	Explain rounding off	
	B. Three siginificant digits		
	C. Decimal between first two		
	IV. Positive exponent function		
	V. Negative exponent function		
	VI. Addition	Work practice problems	
	A. Exponents must be same		
	1. Move decimal point		
	2. Each place left +1		
	3. Each place right -1		
	B. Add ordinary numbers	Work problems on chalkboard	
	C. Exponents stay same		
	VII. Subtraction - same rules as addition		
	VIII. Multiplication		
	A. No exponent change	Demonstrate	
	B. Multiply ordinary numbers		
	C. Algebraically add exponents		
	IX. Division		
	A. Requires new steps		
	1. Lower exponent to top		

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Mathematics	Related Knowledge (cont'd)		
(continued)	2. Sign changed		
	3. Exponents combined		
	4. Becomes exponent for answer	Demonstrate using Ohm's Law	
	B. Divide ordinary numbers	Assign practice problems	

MAJOR BLOCK I

ORIENTATION

TASK: 3. Metric Prefixes

AIM: The student will be able to identify and use metric prefixes in electronic measurements and conversions.

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Mathematics	Related Knowledge		
	I. Advantage	Discussion	Ref. #7, De Guilmo, Joseph M., Electricity-Electronics Principles and Applications, Delmar Publishers, Inc., Albany, NY 12205
	A. Simple and specific		
	B. Basic electrical units		
	C. Converts to scientific notation		
	1. Easy to compute		
	2. Estimations faster		
	3. Miltiples of + or -3		
	II. Prefix - Values - Symbols	List on chalkboard	
	A. Tera		
	1. 1,000,000,000,000 = 10^{12}		
	2. Capital "T"		
	B. Giga	Apply to electrical units	
	1. 1,000,000,000 = 10^{9}		
	2. Capital "G"		
	C. Mega		
	1. 1,000,000 = 10^{6}		
	2. Capital "M" or meg		
	D. Kilo		
	1. 1,000 = 10^{3}		
	2. Small "k"		
	E. Milli		
	1. 0.001 = 10^{-3}		
	2. Small "m"		
	F. Micro		
	1. 0.000,001 = 10^{-6}		
	2. Greek		
	G. Nano		
	1. 0.000,000,001 = 10^{-9}		
	2. Small "n"		
	H. Pico	Practice conversions	
	1. 0.000,000,000,001 = 10^{-12}	Quiz	
	2. Small "p"		

MAJOR BLOCK I ORIENTATION	TASK: 4. Calculators AIM: The student will be able to use a calculator to solve math problems in electronics.		
MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Mathematics	Related Knowledge		
	I. Students to study owner's manual for their calculators	Discussion	Ref. #8, Staff, Understanding Calculator Math, Texas Instruments Learning Center, P.O. Box 225012 MS 54, Dallas, TX 75265
	II. On/clearing		
	III. Display check	Demonstrate	
	IV. Data entry with floating decimal point		
	V. Basic operation	Work simple problems	
	VI. Algebraic operating system		
	VII. Calculator functions		
	A. Parentheses keys		
	B. Scientific notation		
	1. Mantissa		
	2. Exponent		
	C. Exponential shift		
	D. Inverse function key	Explain	
	E. Memory keys		
	F. Square and square roots		
	G. Powers and roots		
	I. Percentage key		
	J. "Pi" key		
	K. Angular measure key		
	1. Degrees		
	2. Radius		
	3. Grads		
	L. Trig function keys		
	1. Sine	Instructor prepared assignment sheet	
	2. Cosine		
	3. Tangent	Quiz	
	M. Logarithm keys		

MAJOR BLOCK II BASIC SKILLS	TASK: 1. Electronic Components AIM: The student will be able to identify the basic electronic components by name, letter symbol, and schematic symbol and describe their function.		
MINOR BLOCK A	**INFORMATION & TASK DETAIL**	**SUGGESTIONS FOR TEACHING**	**REFERENCES & AIDS**
Components and Symbols	Related Knowledge I. Power source A. Types B. Function C. Rating D. Symbol 1. Schematic 2. Letter	Reading assignment Pass out: Information Sheet	Reference # 11, Grob, Bernard, Basic Electronics, Gregg/McGraw-Hill, 1221 Avenue of the Americas, NY., N.Y. 10020, 1984 Information Sheet: teacher prepared
	II. Fuse A. Type B. Function C. Rating D. Symbol 1. Schematic 2. Letter	Display and discuss components to: 1. Type 2. Function 3. Rating 4. Symbol - both letter and schematic	Samples
	III. Switches A. Function B. Rating C. Types 1. SPST 2. SPDT 3. DPST 4. DPDT 5. PBNO 6. PBNC 7. Rotary switch D. Symbol 1. Schematic 2. Letter	Draw symbols on chalkboard Have students take notes Oral questions	
	IV. Meters A. Function B. Rating C. Types 1. Ammeter 2. Voltmeter 3. Ohmmeter	Test 1. Identification 2. Symbols 3. Function	Test: teacher prepared

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Components and Symbols	Related Knowledge (cont.)		
	D. Symbol		
	1. Letter		
(continued)	2. Schematic		
	V. Resistors		
	A. Function		
	B. Rating		
	C. Types		
	1. Fixed		
	2. Tapped		
	3. Potentiometer		
	4. Rheostat		
	D. Symbol		
	1. Letter		
	2. Schematic		
	VI. Capacitors		
	A. Function		
	B. Rating		
	C. Types		
	1. Fixed		
	2. Electrolytic		
	3. Variable		
	D. Symbol		
	1. Letter		
	2. Schematic		
	VII. Lamps		
	A. Function		
	B. Rating		
	C. Types		
	1. Incandescent		
	2. Neon		
	D. Symbols		
	1. Letter		
	2. Schematic		
	VIII. Inductors (coils)		
	A. Function		
	B. Rating		
	C. Types		
	1. Fixed - air core		
	2. Fixed - iron core		
	3. Tapped		
	4. Adjustable		

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Components and Symbols (continued)	D. Symbols		
	1. Letter		
	2. Schematic		
	IX. Transformers		
	A. Function		
	B. Rating		
	C. Types		
	1. Air core		
	2. Iron core		
	3. Autotransformer		
	D. Symbols		
	1. Letter		
	2. Schematic		
	X. Diodes		
	A. Function		
	B. Rating		
	C. Types		
	1. Typical diode		
	2. Zener diode		
	XI. Transistors		
	A. Function		
	B. Rating		
	C. Types		
	1. NPN Bipolar		
	2. PNP Bipolar		
	3. N Channel FET		
	4. P Channel FET		
	5. SCR, TRIAC		
	D. Symbols		
	1. Letter		
	2. Schematic		
	XII. Solar cell		
	A. Function		
	B. Symbol		
	1. Letter		
	2. Schematic		
	XIII. Connection and conductors		
	A. Function		
	B. Symbols		

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Components and Symbols (continued)	Related Knowledge (cont.) 1. Conductor 2. No connection 3. Connection 4. Chassis connection 5. Ground connection 6. Terminal		
	Task Detail 1. Identify component parts: a. Name b. Letter symbol c. Schematic symbol 2. Draw schematic symbols for components 3. Identify function of components	Review lesson Assign task Supervise practice Check students' work	

MAJOR BLOCK II BASIC SKILLS	TASK: 2. Read Electronic Diagrams AIM: The student will be able to identify the various types of electronic diagrams and to interpret a circuit schematic.		
MINOR BLOCK A	**INFORMATION & TASK DETAIL**	**SUGGESTIONS FOR TEACHING**	**REFERENCES & AIDS**
Components and Symbols	Related Knowledge		
	I. Function of electronic diagram	Discuss the different types of diagrams as to:	
	A. Circuit interconnection	1. Use	
	B. Components of the circuit	2. Advantage	
	II. Types	3. How to draw	
	A. Block diagram	Display samples	Samples
	1. Single components may not be shown	Oral question Have students:	
	2. Shows interconnection of sections	1. Identify symbols on a diagram	
	3. Provides idea of how product functions	2. Determine parts list 3. Draw a pictorial and schematic of a circuit provided	
	B. Pictorial diagram		
	1. Provide exact physical placement of component		
	2. Show top view of power supply		
	C. Schematic diagram		
	1. Shows exact location of components		
	2. Connections		
	3. Normally flows left to right		
	4. Numbered symbols used for components		
	a. Parts list coded to numbered symbols		
	b. Vital information provided		
	III. Parts list	Explain purpose	
	A. Purpose	Discuss information contained	
	B. Information contained	Demonstrate making a parts list	
	C. Procedure for writing		
		Show example	Sample

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Components and Symbols (continued)	Task Detail 1. Identify symbols from a schematic 2. Draw a pictorial diagram from a circuit provided 3. Label symbol 4. Draw a schematic diagram from a circuit provided 5. Label symbols 6. Make a parts list	Review symbols Review procedure for making a diagram Assign task Supervise practice Check students' performance	

MAJOR BLOCK II

BASIC SKILLS

TASK: 1. Tool and Equipment Check-Out Procedure

AIM: The student will be able to identify and perform responsibly and safely in the use, care of, and storage of tools and equipment.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Tools and Lab Procedure	Related Knowledge		
	I. Class organization A. Importance B. Personal opportunities C. Duties and responsibilities D. Rotation assignments E. Official duties and reports	Pass out: Information Sheet Discussion Oral questions	Information Sheet: teacher prepared Sup. Ref. C
	II. Laboratory activities A. Storage procedure B. Check-out system C. Responsibility for equipment D. Maintenance and care E. Return of tools and equipment	Tour storage area Discuss procedure	
	III. Shop activities A. Operation hazards B. Work experience 1. Equipment storage 2. Parts requisitioning 3. Job procedures 4. Use of basic equipment	Demonstrate: 1. Check-out procedure 2. Maintenance of tools and equipment 3. Check-in procedure	
	IV. Housekeeping A. Responsibilities B. Specific assignments		

MAJOR BLOCK II

BASIC SKILLS

TASK: 2. Tools - Hand and Power

AIM: The student will be able to identify, select, and properly use those tools that are common to the trade and demonstrate a safe work attitude.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Tools and Lab Procedure	Related Knowledge		
	I. Hand tools	Reading assignment	
	A. Types	Pass out: Information Sheet	Information Sheet: teacher
	1. Chisels	Discuss lesson	Sample tools
	2. Files	Display tools and identify	
	3. Hammers	Use audio-visuals:	Teacher prepared, available films, and manufacturer's charts
	4. Hacksaws	1. Transparencies	
	5. Nut driver	2. Films	
	6. Pliers	3. Charts	
	7. Punches	Oral questions	
	8. Rivet gun		
	9. Rules		
	10. Screwdrivers		
	11. Tube extender sockets		
	12. Wire gauges		
	13. Wire strippers		
	14. Wrenches		
	15. Hemostat clamp		
	B. Selection and use	Demonstrate and discuss:	
	1. Job required	1. Selection	
	2. Procedure in use	2. Use	
	3. Safety	3. Maintenance and reconditioning	
	C. Maintenance		
	1. Storage	4. Storage	
	2. Servicing	5. Safety	
	3. Reconditioning		
	II. Power tools	Pass out: Information Sheet	Information Sheet: teacher prepared
	A. Drills	Demonstrate and discuss:	
	1. Types	1. Types of power tools	Samples
	a. Bench	2. Maintenance	
	b. Floor	3. Safety	
	c. Portable	4. Proper use	
	2. Nomenclature	Show: Transparencies or film on the use	Transparencies: teacher prepared
	3. Maintenance		

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Tools and Lab Procedures (continued)	Related Knowledge (cont.) 4. Safety 5. Drill bits a. Types b. Sizes c. Reconditioning B. Grinders 1. Types a. Bench b. Floor c. Portable 2. Nomenclature 3. Maintenance 4. Safety 5. Grinding wheels	Oral questions Have students identify tools by name and use	
	Task Detail 1. Identify job and tool requirement 2. Select proper tool 3. Inspect for condition 4. Perform required maintenance 5. Properly perform task 6. Provide maintenance and store 7. Observe safety precautions	Review: 1. Selection and use of tools 2. Emphasize proper maintenance and safety in use of tools Supervise practice Check students' performance	

MAJOR BLOCK II

BASIC SKILLS

TASK: 1. Strip and Tin Wire for Soldered Connection

AIM: The student will be able to properly strip wire and tin wire in preparation for a soldered connection.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Soldering	Related Knowledge		
	I. Definitions A. Service loop B. Stripping C. Tinning D. Flux E. Oxides	Reading assignment Review and discuss definitions and terms	Reference # 9, Herrick, C., Electronic Assembly Techniques, Milwaukie, OR., Hickock Teaching Systems, Inc., 1970
	F. Rosin G. Wetting H. Soldering I. De-soldering	Pass out: Information Sheet	Information Sheet: teacher prepared
	II. Soldering equipment A. Types of heating element 1. Soldering iron 2. Soldering pencil 3. Soldering gun 4. Resistance soldering B. Size 1. Wattage 2. Tip	Display soldering equipment Discuss: 1. Types 2. Sizes 3. Accessories 4. Use 5. Safety 6. Maintenance	Sample Manufacturers' chart Reference # 10, Robertson, L. Paul, Basic Electronics I, Mid-America Vocational Curriculum Consortium, Inc.
	C. Accessories 1. Heat sink 2. Component lead cleaner 3. Mechanical wire stripper 4. Thermal wire stripper 5. Soldering vise 6. Soldering iron holder 7. Crimping tool 8. Solder sucker 9. Isopropyl alcohol 10. Adjustable power source 11. Spaghetti-sleeve insulation 12. Heat shrink insulation D. Maintenance E. Safety	Show: transparency	Transparency: teacher prepared

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Soldering	Related Knowledge (cont.)		
(continued)	III. Solder A. Types 1. Bar 2. Wire a. Solid b. Core B. Alloy mixture 1. Tin and lead 2. 60/40 3. Ratio may vary	Display types of solder and flux agents Discuss: 1. Alloy mixture 2. Use 3. Flux 4. Safety precautions 5. Advantages and disadvantages	Samples
	IV. Flux A. Purpose 1. Cleans tip 2. Cleans material B. Types 1. Acid 2. Rosin 3. Paste or liquid form		
	V. Solder connections A. Non-mechanical 1. Butt a. Wire-to-wire b. Wire-to-flat c. Flat-to-flat d. Wire-to-post e. Wire-to-cup or sleeve f. Wire-to-hole B. Partial mechanical 1. Wire-to-hook 2. Wire-to-flat lug 3. Wire-to-turret or post C. Full mechanical 1. Wire spliced to wire 2. Wire to flat lug 3. Wire to turret or post 4. Wire to crimp sleeve	Show transparency Display different connections Demonstrate and discuss: 1. Selection of connection 2. Preparation of connection a. Wire allowance b. Connectors c. Taping d. Crimping 3. Advantage and disadvantage 4. Application of solder	Transparency: teacher prepared
	VI. Characteristics of solder connection	Show transparency	Transparency: teacher prepared

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Soldering (continued)	Related Knowledge (cont'.)		
	A. Good solder connection 1. Silver, shiny appearance 2. Good wetting of solder to surfaces 3. Connection completely covered 4. Contour of connection visible 5. Insulation intact 6. Gap maintained between insulation and connection 7. Solder surfaces contain no pits or holes	Display solder connections 1. Good connections 2. Poor connections Discuss: 1. Characteristics 2. Causes of defects 3. Corrective measures 4. Results of poor solder connections Oral questions Test	Sample Test: teacher prepared
	B. Poor solder connection 1. Insufficient heat 2. Disturbed joint 3. Excessive solder 4. Insufficient solder 5. Dewetted joint 6. Burnt insulation 7. Rosin solder joint 8. Solder short		
	Task Detail		
	1. Prepare wire a. Select wire b. Cut to length c. Determine type connection d. Strip wire e. Clean wire with isopropyl alcohol f. Twist wire ends g. Place heat sink on stranded wire h. Heat wire end with soldering iron tip i. Apply solder j. Remove heat sink	Demonstrate Provide samples for comparison Stress safety precautions Assign task Supervise practice Inspect performance of student	Job Sheet: teacher prepared Materials and equipment required to perform task

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Soldering (continued)	Task Detail (cont'.) k. Clean tinned wire with isopropyl alcohol l. Inspect solder connection		

MAJOR BLOCK II

BASIC SKILLS

TASK: 2. De-Solder An Electronic Connection

AIM: The student will be able to correctly remove a solder connection and old solder.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Soldering	Related Knowledge		
	I. Purpose of de-soldering A. Remove old solder B. Remove connection	Discuss	Ref. #9
	II. De-soldering methods A. Solder sucker 1. Types/brands 2. Advantage B. Wicking III. Safety	Display different brands of solder suckers Demonstrate procedure and discuss: 1. Preparation 2. Heating 3. Removal of terminal 4. Removal of solder 5. Cleaning of de-soldered terminal	
	Task Detail		
	1. Apply hot iron tip to terminal 2. Pry wire off terminal 3. Remove solder a. Solder sucker b. Wicking method 4. Clean de-soldered joint 5. Clean work area	Review procedure Stress safety precautions Assign task Supervise practice Inspect performance of student	Job Sheet: teacher prepared Materials and equipment necessary to perform task

MAJOR BLOCK II

BASIC SKILLS

TASK: 1. Construct A Simple Circuit Using A Breadboard

AIM: The student will identify those terms associated with circuit fundamentals, complete a schematic, and construct a simple circuit from the schematic using breadboard.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Circuit Construction	Related Knowledge		
	I. Definitions	Reading assignment	Ref. #11
	A. Charge	Pass out: Information Sheet	Information Sheet: teacher prepared
	B. Attraction	Discuss terms and definitions	
	C. Electrical current D. Circuit conductor E. Circuit wiring F. Schematic G. Simple circuit H. Resistance I. Repulsion J. Voltage K. Load		
	II. Coulomb's law III. Ohm's law		
	IV. Circuits	Illustrate on chalkboard	chalkboard
	A. Characteristics	1. Schematic of circuit	
	B. Sources of power	2. Flow of current	
	1. Alternating current	3. Open and closed circuit	
	2. Direct current	Show transparencies	Transparencies: teacher prepared
	C. Circuit elements		
	D. Circuit symbols	Test	Test: teacher prepared
	E. Circuit schematic	Provide student with Job Sheet	Job Sheet: teacher prepared
	F. Open G. Closed H. Wire-wrap connections I. Semiconductors		
	V. Materials VI. Safety		
	Task Detail		
	1. Make schematic drawing	Review procedure	
	2. Make list of required materials and tools	Demonstrate Assign task	
	3. Construct circuit on socket-board	Supervise assignment Inspect students' performance	

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Circuit Construction (continued)	Task Detail (cont'.) 4. Install components 5. Solder the component and trim excess length 6. Fasten power source 7. Check circuit for operation		

MAJOR BLOCK II

BASIC SKILLS

TASK: 2. Repair Printed Circuit Board

AIM: The student will be able to select tools and materials needed to repair a printed circuit board.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Circuit Construction	Related Knowledge		
	I. Refer to II-D-I for related knowledge	Reading assignment Review: 1. Ohm's law 2. Coulomb's law 3. Circuit construction 4. Soldering and de-soldering 5. Wire-wrap connections	Ref. #11
	II. Resistor Replacement A. Removal of old component leads	Demonstrate and discuss procedure	
	B. Attachment of new component leads 1. Clinched 2. Swaged 3. Clipped	Ask questions	
	C. Conductor bridge D. Insulated wire jumper	Provide student with Job Sheet	Job Sheet: teacher prepared
	Task Detail		
	1. Remove components 2. De-solder connections 3. Clean connections 4. Prepare components 5. Attach components	Review procedure Demonstrate	Material required to perform job
	6. Solder components to land 7. Solder conductor bridge 8. Solder insulater wire jumper 9. Repair removed or lifted land 10. Inspect solder connections 11. Clean solder connections 12. Check circuit for operation	Assign task Supervise assignment Inspect students' performance	

MAJOR BLOCK II

BASIC SKILLS

TASK: 1. Test Circuit With A Meter

AIM: The student will be able to define terms, demonstrate and describe the functions of the controls, and test circuits with a voltmeter, ammeter, and ohmmeter.

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Meters and Instruments	Related Knowledge		
	I. Function of meters	Reading assignment	Ref. #11
	II. Parameters	Discuss lesson	
	A. Definition	Oral questions	
	B. Electrical parameters measured		
	1. Voltage	Pass out Information Sheet	Information Sheet: teacher prepared
	2. Current		
	3. Resistance		
	III. Types of meters	Display voltmeter	Voltmeter
	A. Voltmeter	Explain:	Wall charts
	1. Types	1. Operational parts	
	2. Function	2. Scales	
	3. Operating principle	3. Operation and use	
	4. Unit divisions	4. Safety and care	
	5. Changing value	Show transparency	Transparency: teacher prepared
	6. Rules for use		
	7. Scale value		
	B. Ohmmeter	Display ohmmeter	Ohmmeter- sample or wall chart
	1. Types	Review:	
	2. Function	1. Operational parts	
	3. Power supply	2. Scales	
	4. Types of ohmmeter circuits	3. Operation and use 4. Safety and care	
	a. Series	Show transparency	Transparency: teacher prepared
	b. Shunt		
	5. Multipliers		
	6. Rules for use		
	7. Circuits in common use		
	C. Ammeter	Display ammeter	Ammeter or wall chart
	1. Types	Review:	
	2. Function	1. Operational parts	
	3. Operating principle	2. Operation and use	
	4. Meter protection	3. Safety and care	

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Meters and Instruments (continued)	Related Knowledge (cont'.) 5. Use of shunts 6. Hazards and limitations 7. Mathematical relationships a. Maximum current b. Average current c. Effective current D. Digital voltmeter	Show transparency Work simple math problems Review Assign problems 1. Math problems 2. Scale reading 3. Measure circuits	Transparency: teacher Assignment Sheet: teacher prepared Test: teacher prepared
	Task Detail Have students: 1. Identify and describe controls 2. Perform circuit test with a voltmeter, ammeter. and ohmmeter	Demonstrate procedure and review Emphasize safety precautions Assign tasks Supervise activity Check students' performance	Job Sheet: teacher Materials and equipment necessary to perform ta

MAJOR BLOCK II

BASIC SKILLS

TASK: 2. Test Circuits With A VOM Analog Multimeter

AIM: The student will be able to define terms, demonstrate, describe the functions of switches and controls, and test circuits with the VOM/Analog Multimeter.

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Meters and Instruments	Related Knowledge I. Function II. Types A. VOM B. VTVM C. TVM III. Type measurements A. Current B. Resistance C. Voltage IV. Controls	Reading assignment Pass out Information Sheet Pass out manuals Define and discuss terms Display multimeters and explain: 1. Operational parts 2. Scales 3. Operation 4. Safety and care	Ref. #7 Information Sheet: teacher prepared Manufacturer's manual Sample meters or manufacturer's chart
	A. Function switch 1. Mode of operation 2. Current 3. Resistance 4. Voltage a. Direct current b. alternating current B. Range switch 1. Selects instrument range 2. Sensitivity range 3. AC/DC scales C. Leads D. Jacks E. Switches	Explain how to use manual Show transparencies: 1. Multimeter 2. Scales 3. Reading scales	Manufacturer's manual Transparencies: teacher prepared
	V. Disadvantages A. Low impedance imput B. Determination of true value	Review the advantages and disadvantages of different types	
	VI. Advantages VII. Safety VIII. Maintenance and care	Review: 1. Safety precautions 2. Handling 3. Storage	

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Meters and Instruments (continued)	Related Knowledge (cont'.)	Work problems Test Assign problems 1. Math 2. Read scales 3. Measure circuit	Teacher prepared Manual Teacher prepared
	Task Detail RESISTIVE MEASUREMENT 1. Circuit turned off a. Caution b. Meter damage 2. Disconnect one lead of resistor in circuit 3. Select mode and range 4. Adjust pointer to zero a. Done each time range is changed b. Leads connected to meter 1.) Black to negative 2.) Red to positive c. Touch leads together d. Adjust pointer to 0 5. Switch ranges a. Pointer near middle b. Gives more accuracy 6. Adjust again to 0 7. Read number 8. Multiply by scale	Demonstrate Review procedure Emphasize safety and instrument care Assign task Supervise assignment Inspect students' performance	Job Sheet: teacher prepared Materials and equipment necessary to perform task
	VOLTAGE MEASUREMENT 1. Select mode a. Volts b. AC-DC 2. Set on highest range a. Caution b. Meter damage		

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Meters and Instruments (continued)	Task Detail (cont'.) 3. Connect leads to meter a. Caution b. Shock possible c. Use one hand 4. Connect leads to circuit a. Black first b. Common side safest c. Measure across 5. Reversed polarity a. Pointer moves wrong b. Switch leads 6. Switch ranges to highest pointer reading 7. Read voltage CURRENT MEASUREMENTS 1. Select current mode 2. Select AC or DC 3. Set for highest range 4. Connect leads to meter 5. Turn circuit off 6. Disconnect wire in circuit 7. Connect meter into circuit a. Red to positive b. Black to negative 8. Energize circuit 9. Switch to lowest safe range 10. Read meter		

MAJOR BLOCK II BASIC SKILLS	TASK: 3. Test Circuits With An Oscilloscope AIM: The student will be able to define terms, demonstrate and describe the functions of switches and controls, and determine the meagnitude and polarity of direct current voltage.		
MINOR BLOCK E	**INFORMATION & TASK DETAIL**	**SUGGESTIONS FOR TEACHING**	**REFFRENCES & AIDS**
Meters and Instruments	Related Knowledge I. Function A. View and measure voltage waveforms B. Displays changes in signal amplitude C. Displays time frame D. View one or more signals II. Types A. Recurrent sweep B. Triggered sweep III. System and controls A. Cathode ray tube (CRT) 1. Electronic gun 2. Deflection 3. Luminescence B. Horizontal position C. Vertical position D. Time/CM E. Volts/CM F. Intensity G. Focus H. Astigmatism I. Horizontal gain switch J. Horizontal level K. Trigger level L. Probe calibrate M. Inputs IV. Advantages A. High impedance B. Very sensitive C. Show dual or multiple traces D. Measures time	Assigned reading Pass out Information Sheet Illustrate and discuss: 1. Operation 2. Controls 3. Function of controls 4. Proper use Have students: 1. Identify controls 2. Define functions 3. Use instrument manual 4. Identify proper use and care	Ref. #7 Information Sheet: teacher prepared Transparency: teacher prepared Wall charts Display sample Instrument manual

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Meters and Instruments (continued)	Related Knowledge (cont.) V. Disadvantages A. Voltage measurement only B. Large and heavy C. Require line voltage D. Less accurate than VOM		
	Task Detail Have students: 1. Identify the controls of a triggered single trace oscilloscope 2. Measure peak-to-peak AC waveform values with an oscilloscope using an AF generator as a signal source 3. Determine relationship between the oscilloscope sweep (horizontal) setting and the frequency of the signal being measured	Demonstrate procedure and review Emphasize safety Assign task Supervise work Check students' progress	Job Sheet teacher prepared Material and equipment necessary to perform task

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 1. Structure Of Matter

AIM: The student will be able to describe movement of electronics; discuss the law of electrical charges; and demonstrate the ability to create and observe the behavior of electrical charges.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity	Related Knowledge		
	I. Nature of matter A. Atoms B. Compounds C. Molecules D. Elements	Reading assignment Pass out: 1. Information Sheet 2. Assignment Sheet Discuss:	Ref. #11 Information Sheet: teacher prepared Assignment Sheet: teacher prepared
	II. Structure of Atoms A. Electrons B. Neutrons C. Protons D. Nucleus E. Electron shells	1. Objectives of unit 2. Definitions 3. Relationship of parts of the atom Show transparency: The structure of an atom	Transparency: teacher prepared
	III. Location of atomic particles A. Nucleus 1. Protons 2. Neutrons	Illustrate on chalkboard	Chalkboard
	B. Orbiting nucleus 1. Electrons 2. Inner orbit 3. Outer orbit IV. Law of electrical charges A. Ion 1. Positive 2. Negative B. Repulsion and attraction 1. Like charges repel 2. Unlike charges attract	Test	Test: teacher prepared
	Task Detail		
	Produce and observe the behavior of electrostatics 1. Suspend two pitch balls or balloons connected by a thread or string 2. Positively charge a glass rod by rubbing with silk or wool 3. Bring rod near pith balls	Demonstrate experiment Assign task Supervise practice Check students' progress	Job Sheet: teacher prepared Materials required: 2 - pith balls or ballons String Silk or wool cloth Glass rod Stand

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity (continued)	Task Detail (cont'.) 4. Observe the attraction the balls have for the rod 5. Observe the balls for repulsion as they touch the rod 6. Explain why the rod attracted and then repelled the balls		

MAJOR BLOCK III
DIRECT CURRENT CIRCUITS

TASK: 2. Conductors and Insulators
AIM: The student will be able to determine conductance of various substances and select materials for specific uses.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity	Related Knowledge		
	I. Electrostatic field	Illustrate on chalkboard	Ref. #11
	II. Unit coulomb	Reading assignment	
	III. Electrical discharge		
	IV. Free electrons	Transparencies	Transparencies: teacher prepared
	V. Current and voltage		
	VI. Insulators and conductors		
	VII. Relative conductivity		
	Task Detail		
	1. Connect bulb and battery with copper wire. Note glow	Demonstrate and explain	1½ volt cell #112 (1.2v.) flashlight bulb with socket Various sizes copper wire Other wire as available Distilled water and salt
	2. Connect as before using nichrome wire and note glow		
	3. Use samples of other wire and note		
	4. Substitute distilled water circuit		
	5. Add salt to water and note glow	Review Test	

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 3. Use and Test Battery

AIM: The student will be able to explain the operation of primary cells and charge a battery using solar cells.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity	Related Knowledge		
	I. Static electricity	Demonstrate and explain	Ref. #11
	A. Causes		
	B. Lightning		
	C. Hazards and safeguards	Summary	
	II. Primary cell	Demonstrate simple cell operation	Coins, vinegar, lemon Sensitive DC meter
	A. Various substances		
	B. Effects of chemicals	Explanation	
	C. Applications		
	D. Polarization		
	E. Advantages and disadvantages		
	III. Solar-cell theory	Explain and illustrate	Film: "Bell Solar Battery," Bell System Telephone Offices
	A. As a generating device	Show film and discuss	
	B. Multiple connections	Oral questions	
	C. Capacity		
	Task Detail		
	1. Dissect carbon-zinc cell	Demonstrate cell construction	
	a. Place in vise		
	b. Saw lengthwise		
	c. Use caution		
	d. Open carefully		
	e. Save zinc and carbon		
	2. Assemble primary cell	Demonstrate	Half-pint jar, weak solution sulfuric acid, water, 1½ volt lamp DC voltmeter
	a. Clean zinc and carbon		
	b. Fill jar half full with H_2O		
	c. Caution: Do not allow acid on person, clothing, equipment		
	d. Slowly add specified amount of acid		
	e. Place electrodes		
	f. Wash hands		
	g. Measure voltage		

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity	Task Detail (cont'.)		
(continued)	h. Connect lamp	Summarize	
	i. Check voltage with load on cell	Oral questions Demonstrate and discuss	Solar cell kit
	3. Connect solar cells in parallel	Task assignment	VTVM, VOM
	a. Measure open-circuit voltage	Practice	Resistor assortment
	b. Apply normal load		
	c. Measure and record		
	4. Connect cells in series and repeat steps above	Summarize Test	Test: teacher prepared
	5. Connect for battery charging and record results		

MAJOR BLOCK III DIRECT CURRENT CIRCUITS	TASK: 4. Generate Electricity With Pressure AIM: The student will be able to explain the fragile nature of crystal generators and check operational ability.		
MINOR BLOCK A	**INFORMATION & TASK DETAIL**	**SUGGESTIONS FOR TEACHING**	**REFERENCES & AIDS**
Basic Electricity	Related Knowledge		
	Piezo-electrical effect I. How voltage is produced II. Piezo-electrical substances III. Uses IV. Mechanical arrangement A. Crystal phono-pickup B. Crystal microphone	Explanation Illustration Oral questions Show film Discussion	Ref. #13, Singer, Phyllis and Blan Holden, Crystals and Crystal Growing, Doubleday, 501 Franklin Ave., Garden City, NY 11531 Film: "Crystals, An Introduction", Bell Telephone System
	Task Detail		
	1. Measure output of phono-pickup a. Connect to AC-VTVM or oscilloscope b. Set on low scale c. Start motor d. Set on record e. Study, read maximum 2. Grow crystal seeds a. Stir Rochelle salts into ½ cup water until no more will dissolve b. Pour saucer ½ full c. Let dry out completely Note: do not touch d. View crystal under microscope and compare	Demonstration Discussion Task assignment Practice on task Oral questions Performance test	VTVM or sensitive oscilloscope Phono turntable with inexpensive crystal, monaural type 6 oz. Rochelle salts (drug store type) Flat glass or ceramic container 6 oz. distilled water Microscope

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 5. Generate Electricity With Heat

AIM: The student will be able to make practical use of thermocouple principle.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity	Related Knowledge		
	Thermocouples		
	I. Principles of operation	Explanation with diagram	Ref. #11
	II. Types	Reading assignment	Millivolt generator
	III. Uses	Show operation	Multimeter
	IV. Testing thermocouples	Oral questions	50 millivolt meter
		Test	Heat source
			Test: teacher prepared
	Task Detail		
	CONSTRUCT THERMOCOUPLES	Demonstrate	Iron wire
	1. Select proper materials		Copper wire
	2. Twist ends tightly		0-50 micrometer
	3. Connect to meter		Heat source
	4. Heat twisted end	Discussion	
	5. Read meter	Task assignment	
	6. Check polarity	Practice on task	
	7. Connect several thermocouples in circuit	Performance task	
	8. Heat simultaneously		
	9. Read meter		

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 6. Generate Electricity With Magnetism

AIM: The student will be able to utilize the principles of electro-mechanical source of electricity constructing a simple generator and recognize common faults.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity	Related Knowledge		
	Electro-mechanical generator		
	I. Mechanical construction	Exhibit disassembled unit	Ref. #11
	II. Nomenclature of parts	List on chalkboard and pronounce	
	III. Principle of operation		
	IV. Proper care	Ask questions, invite discussion	
	V. Control devices		
		Test	Test: teacher prepared
		Discussion	
	Task Detail		
	CONSTRUCT GENERATOR		
	1. Wind 2" coil of 10 turns	Review:	
	2. Connect to DC meter	Proper plane of rotation	
	3. Rotate in magnetic field	Polarity reversal	
	4. Note voltage output	Need for commutator	
	5. Wind coil of 100 turns	Relative voltage output	
	6. Rotate in same field	Left-hand rule for generators	Permanent magnet
	7. Note voltage output	Demonstration	Magnet wire
	8. Note polarity reversal with direction changes		Sensitive DC meter

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 7. Voltage and Polarity

AIM: The student will be able to understand the meaning of voltage and polarity and will will be able to properly connect voltmeter and read scale.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity	Related Knowledge		
	I. Meaning of potential	Definition on chalkboard	Ref. #11
	II. Significance of "potential-difference"	Ask questions Definition on chalkboard	Chalkboard
	III. Net effect of "equal potential"		
	IV. Electron direction	Explain and discuss	
	A. Early concept		
	B. Actual direction		
	C. Confusing result		
	D. Modern convention		
	V. Units of measure		
	A. Microvolt		
	B. Millivolt		
	C. Volt		
	D. Kilovolt		
	VI. Meter scales		
	A. Proper selection		
	B. Reading techniques		
	VII. Meter sensitivity		
	A. Meaning		
	B. Mathematics		
	C. Effect on circuit		
	Task Detail		
	1. Measure voltage	Demonstration	VOM or VTVM
	a. Set meter to proper range	Discussion	4 dry cell, assorted sizes
	b. Connect negative lead to negative of circuit	Task assignment Practice on task	
	c. Connect positive lead to positive of circuit		
	d. Read voltage on scale for which meter is set		
	e. Read readings of all four cells and compare	Oral questions Performance test	

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity (continued)	Task Detail (cont'.) f. Connect cells 1.) 2 in series 2.) 2 in parallel 3.) 4 in series 4.) 4 in parallel g. Measure voltage on each of above and record 2. Make comparison of connections and resulting voltage		

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 8. Determine Resistor Values

AIM: The student will be able to identify and determine the resistance value of resistors by their color code and to measure circuit resistance with an ohmmeter.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity	Related Knowledge		
	I. Types of resistors A. Fixed resistor	Reading assignment Discuss lesson	Ref. #10
	1. Carbon composition 2. Wire wound 3. Film and ceramic B. Adjustable resistor 1. Variable (tapped) 2. Rheostat/Potentiometer	Pass out: Information Sheet	Information Sheet: teacher prepared
	II. Composition of resistors A. Fixed resistor 1. Carbon composition 2. Carbon film 3. Metal film	Illustrate: 1. Types of resistors 2. Symbols 3. Color code	
	4. Wire wound B. Variable 1. Potentiometer 2. Rheostat 3. Thermistor 4. Photoresistor III. Resistor uses A. Limit current B. Dissipate heat C. Produce light	Show transparencies	Transparencies: teacher prepared
	IV. Symbols A. Letter B. Schematic V. Resistor color-code A. Four-band system B. Five-band system	Have students: 1. Identify resistors 2. Determine resistance value 3. Identify types of resistor symbols	
	VI. Power rating A. Construction B. Power dissipated	Test	Test: teacher prepared

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity (continued)	Task Detail 1. Determine value of resistor by color code 2. Measure circuit resistance with ohmmeter	Demonstrate Assign the task Supervise practice Check students' work	Job Sheet: teacher prepared Materials and equipment necessary to perform task

MAJOR BLOCK III DIRECT CURRENT CIRCUITS	
	TASK: 9. Calculate Wire Diameters, Cross-Sectional Areas, and Resistance
	AIM: The student will be able to describe the functional features of conductors and insulators and to calculate wire diameters, cross-sectional areas, and resistance.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity	Related Knowledge		
	I. Conductors	Reading assignment	Ref. #11
	A. Determining factors		
	1. Material properties	Information Sheet	Information Sheet: teacher prepared
	2. Length		
	3. Cross-section area		
	4. Temperature		
	B. Characteristics		
	1. Low resistance	Discuss lesson	
	2. Little voltage drop	Define terms	
	C. Application		
	1. Wiring		
	2. Switches		
	3. Fuses	Display:	
	4. Circuit breakers	1. Types and sizes of conductors	Sample
	5. Lamp filaments		
	D. Types of conductors	2. Insulators	
	1. Solid		
	2. Stranded	Discuss function and properties of each	
	3. Wire braid		
	4. Coaxial cable		
	5. Flat cable		
	6. Twin-lead cable		
	E. Size		
	1. Wire gauge	Show transparencies	Transparencies: teacher prepared
	2. Measured in Mils		
	3. Cross-sectional area		
	4. American Standard Wire Gauge		
	5. Wire gauge chart		
	6. Relationship to resistance		
	F. Properties		
	1. Resistivity		
	2. Temperature co-efficient		

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity (continued)	Related Knowledge (cont'.) 3. Melting point II. Insulator A. High resistant B. Type material C. Characteristics 1. High resistance to electrical current 2. Store electrical charge 3. High dielectric strength D. Properties 1. High resistance 2. Tough 3. Flexibility 4. Non-deterioration		
	III. Wire conductance A. Formula B. Unit-Mho C. Symbols	Demonstrate 1. Calculation of resistance/conductance 2. Measuring wire size	
	1. Letter 2. Schematic	Have students: 1. Calculate wire diameters 2. Cross-sectional areas 3. Resistance	Job Sheet: teacher prepared
		Test students	Test: teacher prepared

MAJOR BLOCK III
DIRECT CURRENT CIRCUITS

TASK: 10. Measure Voltage
AIM: The student will be able to define terms and demonstrate the ability to measure voltage and voltage drop with a voltage meter.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity	Related Knowledge		
	I. Define	Reading assignment	Ref. #11
	A. Voltage	Pass out Information Sheet	Information Sheet: teacher prepared
	B. Current	Discuss	
	C. Resistance		
	D. Formulas		
	II. Sources of voltage		
	A. Batteries		
	B. Generators	Show transparencies	Transparencies: teacher prepared
	C. Alternators		
	D. Electronic power units		
	III. Voltage symbols		
	A. Letter		
	B. Schematic		
	C. Definitions		
	IV. Voltmeters	Demonstrate:	
	A. Operation	1. Use of voltmeter	
	B. Meter movements	2. Math calculations	
	C. Sensitivity	Discuss procedure for assignment	
	D. Multipliers		
	E. Meter conversion		
	V. Kirchhoff's law	Test	Test: teacher prepared
	VI. Current flow		
	VII. Polarity		
	VIII. Voltage drop		
	Task Detail		
	Have students:	Caution students	Job Sheet: teacher prepared
	1. Read scales on voltmeter	Demonstrate assignment	Materials and equipment necessary to perform task
	2. Measure voltage of various batteries	Assign task Supervise work	
	3. Measure voltage drop	Check students' performance	

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 11. Measure Current

AIM: The student will be able to define terms; measure current with and compare current at different points and different power levels.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Basic Electricity	Related Knowledge		
	I. Terms	Reading assignment	Ref. #11
	II. Ammeters	Pass out Information Sheet	Information Sheet: teacher prepared
	A. Meter movements		
	B. Sensitivity	Discuss lesson	
	1. Current requirement	Show transparencies	Transparencies: teacher prepared
	2. Voltage requirement		
	3. Scale deflection		
	4. Movement resistance		
	C. Operation		
	1. Principle	Have students:	
	2. Magnetic field	1. Define terms	
	3. Needle deflection	2. Define prefixes	
	D. Meter shunt E. Shunt calculations	3. Convert amperes to milliamps and microamps	
	F. Ammeter connections	4. Read ammeter	
	1. Series	5. Identify symbols	
	2. Polarity		
	3. Shunt resistor		
	III. Symbols		
	A. Current		
	B. Ampere		
	C. Coulomb		
	D. Ammeter	Review	
	E. Milliamp	Test	Test: teacher prepared
	F. Microamp		
	G. Picoamp		
	Task Detail		
	Have students perform the following jobs:	Caution students Demonstrate task	Job Sheet: teacher prepared
	1. Measure and compare current at different points of a current	Assign task Discuss procedure Supervise work	Materials and equipment required to perform task
	2. Measure and compare current at different voltage levels	Check students' performance	

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 1. Measure Current, Voltage, Amperage, and Power

AIM: The student will be able to define Ohm's law and apply Ohm's law to the solving of of voltage, amperage, power, and resistance problems.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Ohm's Law and Power	Related Knowledge		
	I. Electrical terms and definitions A. Volt B. Ohm	Reading assignment Pass out Information Sheet	Ref. #11 Information Sheet: teacher prepared
	C. Ampere D. Watt E. Amperage F. Proportional relationship 1. Direct 2. Inverse	Discuss lesson	
	II. Ohm's law A. Symbols 1. Letter	Show transparency	Transparency: teacher prepared
	2. Schematic B. Equation form C. Circle expression D. Equations 1. Resistance 2. Amperage 3. Voltage	Demonstrate: 1. Use of circle expression of Ohm's law 2. Use of Ohm's law	Chalkboard
	E. Metric prefix numbers 1. Powers	Demonstrate conversion of metric prefix number	
	2. Calculation with powers of ten	Student's assignment: 1. Calculate resistance 2. Calculate amperage 3. Calculate voltage	Assignment Sheet: teacher prepared
	Task Detail		
	1. Connect circuit consisting of knowns E and I	Demonstration Illustrations on chalkboard	Job Sheet: teacher prepared
	2. Read and record	Discussion	DC source
	3. Compute P and R	Task assignment	Assorted resistors
	4. Connect circuit consisting knowns E and P	Practice on task Review problem	Ammeter Voltmeter

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Ohm's Law and Power	Task Detail (cont'.)		
(continued)	5. Read and record	Supervise practice	Wattmeter
	6. Compute I and R	Check students' work	
	7. Connect circuits consisting of knowns		
	8. Read and record		
	9. Compute E and R		
	10. Connect circuit consisting of knowns P and R		
	11. Read and record		
	12. Compute E and I		

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 2. Measure Power In Watts

AIM: The student will be able to compute current using the power formula and determine the power used in resistive circuits.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Ohm's Law and Power	Related Knowledge		
	I. Power related terms	Reading assignment	Ref. #11
	A. Power	Pass out Information Sheet	Information Sheet: teacher prepared
	B. Electrical power		
	C. Measurement of power		
	1. Watt		
	2. Kilowatt		
	3. Microwatt	Review and discuss lesson	
	4. Milliwatt		
	5. Megawatt		
	D. Work		
	E. Fuse		
	F. Circuit breaker	Show transparencies	Transparencies: teacher prepared
	G. Watt meter		
	II. Abbreviations		
	III. Formulas		
	A. Compute electrical power	Demonstrate:	Chalkboard
	B. Power formula properties	1. Calculating power 2. Measuring with a wattmeter	
	IV. Use of power measurement		
	V. Wattage rating of resistors	3. Determination of fuse and resistor power rating	
	VI. Safety precautions		
	A. Circuit		
	B. Personal	Student assignment	Assignment Sheet: teacher prepared
		Test	Test: teacher prepared
	Task Detail		
	1. Compute current with power formula	Review procedure Assign task	DC source Resistors
	2. Measure with a wattmeter	Supervise practice	Wattmeter, ohmmeter, voltmeter, ampmeter, or multimeter fuses
	3. Determine fuse and resistor rating	Check students' work	

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 1. Measure Voltage Drop In A Series Resistant Circuit

AIM: The student will be able to define terms, identify the characteristics of a series resistant circuit, calculate and analyze values in a series circuit, and demonstrate the ability to measure voltage drop.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Series Circuits	Related Knowledge		
	I. Ohm's law	Reading assignment	Ref. #11
	A. Circle memory aid	Review Ohm's law	Ref. #10
	B. Proportional relationship	Pass out Information Sheet	Information Sheet: teacher prepared
	II. Series circuit characteristics A. Current B. Resistance C. Power D. Voltage	Discuss lesson: 1. Terms and definitions 2. Symbols 3. Formulas	
	E. Voltage drop 1. Equal value resistors 2. Unequal value resistors	Show transparencies	Transparencies: teacher prepared
	III. Kirchhoff's voltage law A. Series circuit analysis B. Use C. Formula D. Circuit chart	Demonstrate and explain application	
	IV. Type circuits A. Simple	Illustrate and discuss types of circuits	
	B. Combined C. Open D. Short 1. Direct 2. Partial V. Voltage reference points VI. Polarity of voltage	Assign problems in calculation of: 1. Total voltage 2. Voltage drop across resistances 3. Total resistance	Assignment Sheet: teacher prepared
	Task Detail		
	1. Equipment and materials a. Power supply b. Switch c. Resistors of same value d. Resistors of different value	Demonstrate and review procedure Emphasize safety precautions Assign task Supervise assignment	Job Sheet: teacher prepared Materials and equipment necessary to perform task

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Series Circuits (continued)	Task Detail (cont'd) e. Voltmeter or multimeter 2. Procedure a. Connect circuit b. Read and record values c. Calculate and compare voltage drop d. Compare voltage distribution across equal and unequal value resistance e. Identify negative point in circuit f. Secure materials and equipment	Inspect students' performance	

MAJOR BLOCK III

DIRECT CURRENT
CIRCUITS

TASK: 2. Analyze Current Values In A Series Circuit

AIM: The student will be able to define terms, determine unknown circuit values, and demonstrate ability to measure and analyze current values in a series circuit.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Series Circuits	Related Knowledge I. Refer to major block III, minor block C, Task 1 for related information	Reading assignment Pass out Information Sheet Review: 1. Laws of series circuits 2. Ohm's law 3. Current in a series circuit Show transparencies Assign problems in calculating current values	Ref. #10 Ref. #11 Information Sheet: teacher prepared Transparencies: teacher prepared Assignment Sheet: teacher prepared
	Task Detail 1. Equipment and materials a. Power supply b. Switch c. Resistors d. Ammeter, voltmeter, ohmmeter, or multimeter 2. Procedure a. Determine value of resistors b. Connect circuit according to schematic c. Measure and record voltages across resistor d. Read and record ammeter indication e. Calculate current across resistors f. Compare current computations g. Secure equipment and materials	Demonstrate procedure Review Emphasize safety precautions Assign task Supervise assignment Inspect students' performance	Job Sheet: teacher prepared Materials and equipment necessary to perform task

MAJOR BLOCK III DIRECT CURRENT CIRCUITS	TASK: 3. Analyze Power And Resistance In A Series Circuit AIM: The student will be able to identify terms, calculate the power dissipated, and demonstrate ability to analyze resistance and power in a series circuit.		
MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Series Circuits	Related Knowledge I. Refer to major block III, minor block C, task 1 for related information	Reading assignment Pass out Information Sheet Show transparencies Review: 1. Power in series circuit 2. Power formula 3. Voltage reference points 4. Polarity of voltage	Ref. #11 Information Sheet: teacher prepared Transparencies: teacher prepared
		Assign problems in calculating power	Assignment Sheet: teacher prepared
	Task Detail 1. Equipment and materials a. Power supply b. Switch c. Resistors d. Ammeter e. Multimeter 2. Procedure a. Determine value of resistors b. Connect circuit according to schematic c. Adjust applied voltage d. Read and record: 1.) Total current 2.) Total voltage 3.) Total resistance e. Compute total resistance f. Compare ohmmeter reading to computed value g. Compute total power dissipated h. Compute power dissipated by each resistor	Demonstrate procedure Review Emphasize safety precautions Assign task Supervise assignment Inspect students' assignment	Job Sheet: teacher prepared Materials and equipment necessary to perform task

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Series Circuits (continued)	Task Detail (cont'.) i. Check to see if total power dissipated is equal to power dissipated by the resistor j. Compute maximum voltage that can be applied to resistor k. Secure equipment and materials l. Have work checked		

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 1. Measure And Calculate Voltage, Current, And Resistance In A Parallel Circuit

AIM: The student will be able to define terms, select formulas to use, determine total resistance in a parallel circuit, and measure voltage, current, and resistance in a parallel circuit.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Parallel Circuits	Related Knowledge I. Parallel circuits A. Definition B. Characteristics C. Applications D. Schematic E. Advantage and disadvantage II. Laws of parallel circuits A. Voltage B. Current C. Resistance	Reading assignment Pass out Information Sheet Discuss and review lesson Illustrate: 1. Parallel circuit 2. Schematic drawing 3. Formulas 4. Symbols 5. Reciprocal	Ref. #11 Ref. #6 Information Sheet: teacher prepared Chalkboard
	III. Resistance in parallel circuit A. Use B. Reciprocal C. Conductance 1. Definition 2. Unit of measure 3. Symbol	Show transparencies	Transparencies: teacher prepared
	D. Shunt or parallel Resistors E. Short branch F. Formulas 1. Reciprocal method 2. Unequal branch (product over sum) 3. Equal value resistive branch G. Parallel rule	Assign problems in calculatio of total resistance: 1. Reciprocal method 2. Unequal branch (product over sum) 3. Equal branch method	Assignment Sheet: teacher prepared
	IV. Voltage in parallel circuits A. Law of current B. Advantage C. Source D. Formula	Discuss Demonstrate calculating voltage problem Show transparency Assign problems in calculation of total voltage	Transparency: teacher prepared

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Parallel Circuits (continued)	Related Knowledge (cont'.) V. Current in parallel circuit A. Law of current B. Total or "Main Line" current C. Formula	Discuss Demonstrate calculating current problems Show transparency Assign problems	Assignment Sheet: teacher prepared Transparency: teacher prepared Assignment Sheet: teacher prepared
	Task Detail 1. Equipment and materials a. Battery or power source b. Resistors of equal value c. VOM/Voltmeter d. VOM/Ammeter e. Switch f. Wire 2. Procedure a. Construct circuit according to schematic b. Measure and record applied voltage c. Measure and record voltage across resistors d. Compare readings e. Connect ammeter f. Measure and record current of each branch g. Connect ammeter in series with voltage source and switch h. Record main current i. Compare sum of recorded currents k. Record and compare ammeter indication with both resistors and with only one l. Connect both resistors and using voltmeter read and record applied voltage m. Compute total resistance of circuit	Demonstrate and review procedure Emphasize safety Assign task Supervise assignment Inspect students' performance	Job Sheet: teacher prepared Materials and equipment necessary to perform task

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Parallel Circuits (continued)	Task Detail (cont'.) n. Compute resistance using measured voltage and current value o. Compute total resistance p. Secure equipment		

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 2. Measure Power In A Parallel Circuit

AIM: The student will be able to define terms, perform a circuit analysis, and measure power in a parallel circuit.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Parallel Circuits	Related Knowledge I. Refer to major block III, minor block D, task 1 for related information	Reading assignment Pass out Information Sheet	Ref. #11 Ref. #10 Information Sheet: teacher prepared
	II. Power in parallel circuit A. Application B. Formula 1. Resistance unknown 2. Current unknown 3. Voltage unknown	Discuss and review lesson Demonstrate: 1. Calculation of power 2. Circuit analysis	Chalkboard
	III. Circuit analysis A. Circuit parameters 1. Value changes 2. Value change symbol	Show transparencies	Transparencies: teacher prepared
	B. Law of parameter change IV. Open circuits A. Main line B. Branch line V. Short circuit	Assignments to perform: 1. Compute power 2. Compute values 3. Circuit analysis	Assignment Sheet: teacher prepared
	Task Detail 1. Set up equipment 2. Procedure a. Connect circuit according to schematic b. Close circuit and record main current c. Read and record applied voltage d. Connect ammeter in series with each resistor individually e. Read and record currents for each branch f. Compare main current with sum of recorded currents g. Determine total power supplied by the batteries to the resistors	Demonstrate and review procedure Emphasize safety precautions Assign task Supervise assignment Inspect students' performance	Job Sheet: teacher prepared Materials and equipment necessary to perform task

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 1. Measure And Calculate Values In A Series-Parallel Circuit

AIM: The student will be able to define terms, identify symbols, simplify a series-parallel circuit, and apply rules for calculation of circuit values.

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Series-Parallel Circuits	Related Knowledge		
	I. Series-parallel circuits	Reading assignment	Ref. #11
	A. Definition	Pass out Information Sheet	Information Sheet: teacher prepared
	B. Characteristics	Discuss and review lesson	
	1. Identification	Explain new terms, definitions, and symbols	
	2. Application		
	3. Circuit effects	Illustrate and explain:	Chalkboard
	C. Components and symbols	1. Parallel-series circuits	
	1. Node	2. Series-parallel circuits	
	2. Ground	3. Circuit reduction	
	a. Function	4. Circuit applications	
	b. Types	5. Circuit and equivalent circuit	
	D. Circuit reduction		
	E. Voltage divider	6. Voltage divider	
	II. Parallel-Series circuits	Show transparencies	Transparencies: teache
	A. Definition		
	B. Characteristics		
	III. Rules for calculation		
	A. Kirchhoff's law		
	B. Ohm's law		
	C. Resistance		
	D. Current		
	E. Voltage		
	F. Power		
	IV. Circuits		
	A. Meter		
	B. Bridge		
	C. Delta-Wye	Assign problems	Assignment Sheet: teacher prepared
		1. Calculating current values	
		2. Analyzing circuit	

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Series-Parallel Circuits (continued)	Task Detail 1. Select equipment and materials a. DC power supply b. Multimeter c. Resistors d. Switch 2. Procedure a. Construct circuit according to given schematic b. Measure and record voltage drop c. Measure and record current d. Compute power e. Measure and record applied voltage and total current f. Compute total resistance g. Compute each resistor value h. Compute total resistance with computed resistor values i. Compare total resistance values 3. Secure materials and equipment	Demonstrate and review Emphasize safety Assign task Supervise assignment Inspect students' assignment	Job Sheet: teacher prepared Materials and equipment necessary to perform task

MAJOR BLOCK III DIRECT CURRENT CIRCUITS	TASK: 2. Construct And Analyze The Function Of A Voltage Divider AIM: The student will be able to design a voltage divider circuit, identify terms, analyze the function, and calculate the values of the circuit.

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Series-Parallel Circuits	Related Knowledge I. Refer to major block III, minor block E, task 1 for related information	Review: 1. Ohm's law 2. Series voltage law 3. Parallel current law Reading assignment Pass out Information Sheet	Ref. #11 Ref. #6 Information Sheet: teacher prepared
	II. Voltage dividers A. Definition B. Function C. Application D. Parameters	Review lesson: 1. Define terms 2. Illustrate	
	E. Loads F. Problems G. Bleeder currents	Show transparencies	Transparencies: teacher prepared
	III. Ground reference A. Function B. Types 1. Earth 2. Chassis 3. Common C. Symbols D. Safety	Assign problems calculating power: 1. Voltage across and current through a known load 2. Current through and resistance of a known load 3. Voltage across and resistance of a known load	Assignment Sheet: teacher prepared
	Task Detail 1. Select equipment and materials a. DC power supply b. Multimeter c. Resistors d. Switch e. Lamp 2. Procedure a. Construct circuit according to schematic design	Demonstrate and review procedure Emphasize safety Assign task Supervise assignment Inspect students' assignment	Job Sheet: teacher prepared Equipment and materials necessary to perform task

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Series-Parallel Circuits (continued)	Task Detail (cont'.) b. Measure and record voltage drop across resistors c. Connect load at nodes d. Measure and record voltage resistors with load connected e. Analyze change in voltage drop and direction of change f. Analyze differences observed with and without load 3. Secure equipment		

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 1. Construct An Electromagnet

AIM: The student will be able to define terms, explain the application and effect of induction in the electronic field, construct an electromagnetic device, and explain its industrial application.

MINOR BLOCK F	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Magnetism	Related Knowledge		
	I. Refer to Major Block III, Minor Block E, Task 1, for related information.	Reading assignment	Ref. #11
	II. Electromagnetic effects A. Around conductor B. Field direction C. Around coil	Review: 1. Electromagnetic effects 2. Field strength 3. Interaction of fields Demonstrate and discuss magnetic effects	
	III. Field strength A. Lines of force B. Permeability C. Residual magnetism	Demonstrate and show transparencies	Transparencies: teacher prepared
	Task Detail		
	1. Construct electromagnet a. Cut paper to nail length b. Wrap paper around nail c. Wind wire snugly d. Fasten ends with tape e. Scrape ends of wire f. Connect to battery	Discuss and set up experiment	20 penny nail 1/8 lb. #23 insulated copper wire 1 1/2 - 6 volt source 6 volt stop light bulb Magnetic compass Iron filings
	2. Test electromagnetic effects a. Pick up iron filings b. Remove current c. Observe some filings cling d. Check polarity with compass e. Reverse battery and recheck	Demonstrate	Adhesive tape
	f. Remove nail, connect, and dip g. Note and record results	Discuss results Task assignment Performance test	

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 2. Demonstrate Existence Of Magnetic Lines Of Force Around A Magnet

AIM: The student will be able to identify and utilize magnetic properties of substance in making elementary applications; show existence of magnetic lines around a magnet; and demonstrate that magnetic poles attract and repel.

MINOR BLOCK F	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Magnetism	Related Knowledge		
	I. Definition of magnetism	Reading assignment	Ref. #11
	II. Natural magnet	Demonstrate and explain	
	A. Earth	1. Magnetic properties	Magnetite (lodestone, magnetic materials, magnetized objects)
	B. Loadstone	2. Magnetic poles	
	III. Artificial magnet	3. Types of magnets	
	A. Electromagnet	4. Magnetic lines of force	
	B. Permanent magnet		
	IV. Permeability of magnetic materials	Pass out: Information Sheet	Information Sheet: teacher prepared
	A. High permeability		
	B. Medium permeability	Show transparencies	Transparencies: teacher prepared
	C. Low permeability		
	D. Non-magnetic		
	V. Magnetic poles		
	A. Geographic		
	B. Magnetite		
	C. Magnetized		
	D. Battery		
	VI. Magnetic properties		
	A. Lines of force		
	B. Field		
	C. Flux		
	1. Symbol		
	2. Density		
	VI. Induced magnetism	Discuss and demonstrate:	
	A. Permanent	1. Induced magnetism	
	B. Temporary	2. Left-hand rule	
	C. Effects		
	VII. Left-hand rule		
	A. Conductors		
	B. Coils		

MINOR BLOCK F	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Magnetism	Task Detail		
(continued)	1. Plot magnetic field of bar magnet a. Remove wrist watch b. Place magnet flat on table c. Lay stiff white paper on magnet d. Sprinkle iron filings on paper e. Tap paper lightly f. Record magnetic field 2. Repeat with other magnets 3. Compare results 4. Making floating needle compass a. Fill saucer ½ full of water b. Stroke each end of needle on opposite ends of magnet c. Place needle on 2" square waxed paper d. Place gently on water e. Observe compass action	Demonstrate and review procedure Assign task Supervise assignment Check students' performance	Job Sheet: teacher prepared materials necessary to perform task

MAJOR BLOCK III DIRECT CURRENT CIRCUITS	
TASK:	1. Calculate And Measure Capacitance In A Circuit
AIM:	The student will be able to identify and define the components of a capacitor and measure and calculate values in a circuit.

MINOR BLOCK G	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Inductors and Capacitors	Related Knowledge		
	I. Definition	Reading assignment	Ref. #11
	A. Capacitance	Pass out Information Sheet	Ref. #6
	B. Capacitor		Information Sheet: teacher prepared
	C. Condensor		
	II. Construction	Discuss and review lesson	
	A. Conducting plates	Illustrate and discuss:	Chalkboard
	B. Insulator	1. Capacitor construction	
	1. Material	2. Types	Sample capacitor
	2. Dielectric	3. Capacitor behavior	
	C. Leads		
	III. Types	Show transparencies	Transparencies: teacher prepared
	A. Fixed		
	B. Variable		
	C. Electrolytic		
	D. Oil-filled		
	IV. Characteristics		
	A. Storage of electrical charge		
	B. Capacitor action		
	C. Equivalent circuit		
	D. Factors of performance		
	1. Plate size		
	2. Plate spacing		
	3. Dielectric materials		
	4. Dielectric strength		
	5. Dielectric constant		
	E. Charge and discharge		
	1. Formula		
	2. Resistance		
	3. Non-resistant		
	4. Time constant		
	5. Universal time constant		
	6. Leakage resistant		

MAJOR BLOCK III

DIRECT CURRENT CIRCUITS

TASK: 2. Calculate And Measure Inductance In A Circuit

AIM: The student will be able to identify and define terms and components of a capacitor; construct an RL circuit; calculate circuits' L/R time constant and steady-state current; measure steady-state current; and observe effect on L/R time.

MINOR BLOCK G	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Inductors and Capacitors	Related Knowledge		
	I. Inductance	Reading assignment	Ref. #11
	A. Definition	Pass out Information Sheet	Ref. #6
	B. Effects		Information Sheet: teacher
	1. Stores energy in magnetic field	Review and discuss lesson	
	2. Opposes change in current	Illustrate and discuss: 1. Types of conductors	Chalkboard
	3. Current value change	2. Construction	
	4. Time frame factor	3. Inductance	
	5. Final current value	4. Electromagnetic field	
	6. Current flow with circuit off	5. Electrostatic field	
	C. Electromagnetic field	Show transparencies	Transparencies: teacher prepared
	D. Electrostatic field		
	E. Lines of force		
	F. L/R time constant		
	1. Definition	Demonstrate: determining:	
	2. Formula	1. L/R time constant	
	3. Graph	2. Steady-state value	
	G. Steady-state value		
	1. Definition		
	2. Formula		
	II. Inductors		
	A. Names		
	1. Coil		
	2. Inductor		
	3. Choke		
	4. Solenoid		
	B. Construction		
	1. Core		
	a. Air/insulating core		
	b. Iron core		
	c. Powdered iron core		

MINOR BLOCK G	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Inductors and Capacitors	Related Knowledge (cont'.)		
(continued)	V. Application A. Ignition system B. Medical defibrillator C. Electronics 1. Timing 2. Resonant circuits		
	VI. Symbols A. Fixed B. Variable C. Electrolytic D. Oil-filled	Illustrate symbols and explain	
	VII. Measurement A. Farads B. Microfarads	Illustrate formula and solve problem	
	C. Picofarads	Solve problems	
	VIII. Capacitors in series IX. Capacitors in parallel		
	Task Detail		
	Have students: 1. Identify capacitor components 2. Make schematic drawing 3. Define terms 4. Calculate RC time constant 5. Calculate voltage across capacitor 6. Calculate total capacitance of circuit 7. Calculate time to charge capacitor 8. Compute and measure circuits behavior	Demonstrate procedure Review safety precautions Assign task Supervise work Check students' work	Job Sheet: teacher prepared Materials and equipment necessary to perform task

MINOR BLOCK G	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Inductors and Capacitors (continued)	Task Detail Have students: 1. Identify inductors 2. Make schematic drawing of RL circuit 3. Calculate L/R time constant 4. Calculate steady-state current of circuit 5. Measure steady-state current and observe the effect of L/R time constant	Demonstrate procedure Review safety precautions Assign tasks Supervise assignment Check students' work	Job Sheet: teacher prepared Materials and equipment necessary to perform task

MAJOR BLOCK IV

ALTERNATING CURRENT CIRCUITS

TASK: 1. Compute And Construct A Sine Wave Cycle

AIM: The student will be able to demonstrate knowledge of AC voltage and current by determining sine wave relationship and conversions; compute instantaneous sine wave values, wavelengths and values; and construct a sine wave cycle.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Alternating Voltage and Current	Related Knowledge		
	I. Alternating current	Reading assignment	Ref. #11
	A. Flow direction		Ref. #12
	B. Alternating current voltage	Pass out Information Sheet	Information Sheet: teacher prepared
	C. Alternating current power		
	II. Wave shapes	Show transparencies	Transparencies: teacher prepared
	A. Representation on a graph		
	B. Represent value of electric quantity	Discuss and review lesson	
	C. Magnitude and direction indicated on vertical axis		
	D. Time indicated on horizontal axis	Have students define and identify terms	
	III. Shapes		
	A. Fluctuating direct current		
	B. Pulsating direct current		
	C. Sine wave alternating current		
	D. Square wave AC		
	E. Sawtooth wave AC		
	IV. Quantity		
	A. Cycle		
	B. Half cycle-positive		
	C. Half cycle-negative		
	D. Period		
	E. Frequency		
	1. Symbol		
	2. Unit		
	3. Formula		

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Alternating Voltage and Current	Related Knowledge (cont'.)		
	F. Amplitude		
(continued)	1. Definition		
	2. Peak		
	3. Peak-to-peak		
	4. Average		
	5. Effective or RMS		
	V. Sine wave relationship	Illustrate sine wave conversions	
	A. Degrees and radians		
	B. Cycles and radians	Work sample problems	
	C. Alternation and radians		
	D. Alternations and degrees		
	E. Abbreviations		
	F. Values and sine functions		
	VI. Wavelength		
	A. Co-plete wave length		
	B. Wave velocity		
	1. Sound wave		
	2. Light wave		
	3. Symbol		
	4. Unit		
	5. Formula		
	VII. Phase		
	A. Waves		
	B. In-phase		
	C. Out-of-phase		
	D. Phase angle		
	VIII. Frequency spectrum		
	A. Power frequencies		
	B. Audio frequencies		
	C. Radio frequencies		
	D. Ultrasonic		
	IX. Decibels		
	A. Unit of power level		
	B. Purpose		
	C. Standard or reference		

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Alternating Voltage and Current (continued)	Task Detail Have students perform the following suggested assignments: 1. Determining relationship of current and voltage of a sine wave 2. Compute instantaneous sine voltage values 3. Compute period and wave length 4. Compute and construct a sine wave cycle	Demonstrate and explain procedure Assign tasks Supervise work Check students' performance	Job Sheet: teacher prepared Materials, equipment and components required to perform job

MAJOR BLOCK IV ALTERNATING CURRENT CIRCUITS	TASK: 2. Measure Peak-To-Peak AC Waveform Values With An Oscilloscope AIM: The student will be able to identify controls of an oscilloscope; measure waveform values; and determine the relationship between oscilloscope horizontal setting and the frequency of the signal being measured.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Alternating Voltage and Current	Related Knowledge		
	I. Refer to major block IV, minor block A, task 1, for related information	Review related information from previous lesson Reading assignment	Ref. #11 Ref. #12 Ref. #14
		Pass out Information Sheet	Information Sheet: teacher prepared
	II. Oscilloscopes	Show transparencies	Transparencies: teacher prepared
	A. Function	Demonstrate and explain operation, controls and how to take measurements	Instruction manual for oscilloscope use
	B. Operation		
	1. Block diagram		
	2. Cathode ray tube (CRT)		
	3. Sweep-trace circuits		
	4. Vertical circuits		
	5. Trigger circuits		
	C. Controls		
	1. Power		
	2. Intensity		
	3. Focus		
	4. Scale ilumination	Test	Test: teacher prepared
	5. Magnifier		
	6. Horizontal sweep		
	7. Trigger controls		
	8. Position controls		
	9. Input controls		
	D. Measurements		
	1. Control adjustment		
	2. Voltage measurement		
	3. Peak value		
	4. RMS value		
	5. Average value		
	6. Time period		
	7. Frequency		
	8. Phase measurement		

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Alternating Voltage and Current	Task Detail		
(continued)	Have students perform the following suggested assignments: 1. Identify controls and function of oscilloscope 2. Measure peak-to-peak AC waveform values 3. Determine oscilloscope sweep setting and signal frequency relationship	Demonstrate procedure and review Emphasize operation and safety in use of oscilloscope	Job Sheet: teacher prepared Materials and equipment necessary to perform task

MAJOR BLOCK IV

ALTERNATING CURRENT CIRCUITS

TASK: 3. Compare Alternating Current With Direct Current

AIM: The student will identify terms; make computations; compare alternating effective alternating values.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Alternating Voltage and Current	Related Knowledge I. Refer to major block IV, minor block A, task 1 and 2 for related information	Review related information Demonstrate and review assignment	
	Task Detail Have students perform the following suggested assignment: 1. Compare alternating current and direct current 2. Compare peak, peak-to-peak, and RMS values	Demonstrate procedure Review Assign task Supervise work Check students' performance	Job Sheet: teacher prepared Materials and equipment necessary to perform task

MAJOR BLOCK IV

ALTERNATING CURRENT CIRUITS

TASK: 1. Determine The Effect Of Inductance In AC And DC Circuits

AIM: The student will be able to define terms, symbols, and abbreviations; and experimentally determine effects of inductance, self inductance, and mutual inductance.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Inductance	Related Knowledge		
	I. Inductance	Reading assignment	Ref. #11
	A. Definition		Ref. #6
	B. Self inductance	Pass out Information Sheet	Information Sheet: teacher prepared
	C. General characteristics		
	1. Oppose current change	Discuss and review lesson	Ref. #14, DeVito, *Introduction to Electricity and Electronics*, 2nd Edition, Buck Engineering Co., Inc., Farmdale, NJ
	2. Produce induced voltage		
	3. Induction by varying current		
	4. Coils contain more inductance	Show transparencies	Transparencies: teacher prepared
	5. Symbol		
	6. Unit		
	7. Formula		
	D. Physical characteristics of solenoid		
	1. Number of turns		
	2. Area of each turn		
	3. Permeability of core		
	4. Length of coil		
	5. Formula		
	E. Self inductance	Illustrate and discuss	Samples
	F. Lenz's law		
	II. Types of inductors		
	A. Air core		
	B. Iron core		
	C. Solenoid		
	D. choke		
	E. Coil		
	III. Inductors in circuits	Work problems on chalkboard	Chalkboard
	A. Series		
	B. Parallel		
	C. Formula		

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Inductance (continued)	Related Knowledge (cont'.) IV. Mutual inductance A. Characteristics 1. Symbol 2. Flux leakage 3. Iron core effect 4. Unit B. Coefficient of coupling 1. Definition 2. Symbol 3. Unit 4. Type coupling	Review mutual inductance Define terms Work sample problems using formulas	
	C. Mutual inductance formulas 1. Series no mutual inductance 2. Parallel no mutual inductance 3. Series aiding 4. Series opposing D. Variable inductance 1. Tapped coil 2. Slider contact E. Stray inductance	Test students Assign problems Perform experiments	Test: teacher prepared
	Task Detail Have students perform the following experiments: 1. Demonstrate effects of inductance in AC and DC circuits 2. Demonstrate self inductance 3. Demonstrate mutual inductance	Demonstrate and explain procedure Review safety precautions Assign tasks Supervise work Check students' work	Job Sheet: teacher prepared Equipment and materials required to perform task

MAJOR BLOCK IV

ALTERNATING CURRENT CIRCUITS

TASK: 2. Determine Voltage-Turn Ratio Of Transformers

AIM: The student will be able to define terms, identify symbols, investigate properties of transformers, and determine the significance of the voltage-turn ratio.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Inductance	Related Knowledge		
	I. Review major block I, minor block B, task 1, for related information	Reading assignment	Ref. #11
	II. Transformers A. Characteristics	Show transparencies	Transparencies: teacher prepared
	1. Application of mutual inductance	Illustrate transformer construction	
	2. Transfer power	Discuss and review lesson	
	3. Transfer voltage		
	B. Transformer ratios	Asks questions	
	1. Turn ratio		
	2. Voltage ratio	Calculate ratio problems	Chalkboard
	3. Current ratio C. Secondary current and power 1. Application of Ohm's law 2. Secondary power		
	3. Power ratio	Student assignment	Assignment Sheet: teacher prepared
	D. Auto-transformers 1. Tapped coil 2. Step-up or step-down ratio 3. No electrical isolation between primary and secondary E. Transformer efficiency 1. Power ratio 2. Resistance in wiring 3. Efficiency formula F. Core loss 1. Eddy current 2. Hysteresis loss		

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Inductance (continued)	Related Knowledge (cont'.) G. Core types 1. Laminated 2. Powdered iron 3. Ferrite 4. RF shielding	Test	Test: teacher prepared
	Task Detail Have students perform the following experiment: 1. Construct simple, double-wound transformer 2. Determine significance of voltage turn-ratio	Demonstrate and review procedure Review safety precautions Assign tasks Supervise work Check students' progress	Job Sheet: teacher prepared Materials, equipment, and components required to perform task

MAJOR BLOCK IV

ALTERNATING CURRENT CIRCUITS

TASK: 3. Determine The Effect Inductive Reactance Has On An Alternating Current Circuit

AIM: The student will be able to experimentally determine reactance, inductance, and impedance of a simple AC circuit.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Inductance	Related Knowledge		
	I. Refer to major block IV, minor block B, task 1 and 2 for related information	Reading assignment Pass out Information Sheet	Ref. #11 Information Sheet: teacher prepared
		Review previous lessons	
	II. Inductance reactance	Discuss and review lesson	
	A. Characteristics		
	1. Self induced voltage 2. Symbol 3. Unit 4. Non-existent in DC circuit 5. Reduce current flow in AC circuit	Show transparencies	Transparencies: teacher prepared
	6. Increases with higher frequency 7. Formula	Work problems	
	B Series and parallel inductive reactance		
	C. Application of Ohm's law		
	D. Phase relationship		
	E. Impedance 1. Formula 2. Vector diagram 3. Symbols		
	F. Coil 1. Ratio of inductive reactance to resistance 2. Formula 3. Symbol		

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Inductance (continued)	Task Detail Have students perform the following experiment: 1. Determine inductive reactance effect on AC circuit 2. Determine combined effect of inductive reactance and resistance 3. Show that the phase angle between current and voltage in a series resistive-inductive AC circuit is determined by the amount of inductive reactance and resistance	Demonstrate and review procedure Review safety precautions Assign tasks Supervise work Check students' work	Job Sheet: teacher prepared Equipment, components, and materials required to perform task

MAJOR BLOCK IV
ALTERNATING
CURRENT CIRCUITS

TASK: 1. Identify, Test, And Determine Construction Of A Capacitor

AIM: The student will be able to define terms, symbols, and abbreviations; identify and and test capacitors; examine the construction of a capacitor; identify the functions of capacitance in electrical circuits; and state formulas for capacitance.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Capacitance	Related Knowledge		
	I. Definitions	Reading assignment	Ref. #11
	A. Capacitance		Ref. #6
	B. Capacitor	Pass out Information Sheet	Information Sheet: teacher prepared
	C. Dielectric		
	D. Dielectric constant		
	E. Coulomb	Discuss and review lesson	
	F. Farad		
	II. Capacitors	Illustrate and discuss	Sample capacitor
	A. Construction	1. Capacitance	
	1. Material	2. Capacitor construction	
	2. Plate size	3. Capacitor behavior	
	3. Diaelectric constant	4. Types	
	4. Formula	Show transparencies	Transparencies: teacher prepared
	B. Types		
	1. Fixed		
	2. Variable		
	3. Electrolytic		
	4. Oil-filled		
	C. Symbols		
	D. Values		
	1. Farad		
	2. Microfarad		
	3. Picofarad		
	E. Color coding (EIA)		
	III. Properties of capacitance	Demonstrate:	Chalkboard
	A. Storage of electric charge	1. Jobs to be performed	
	B. Factors of performance	2. Solving problems mathematically	
	C. Capacitor action	3. Operation of measuring instruments	
	1. Voltage increase		
	2. Voltage decrease		
	D. Block DC flow		
	E. Permit AC flow		
	F. Discharge and charge effect		

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Capacitance (continued)	Related Knowledge (cont.) 1. Resistance 2. Non-resistant 3. Time constant 4. Universal time constant 5. Leakage resistant IV. Formula for capacitance A. Total capacitance in parallel B. Total capacitance in series 1. Equal capacitors 2. Unequal capacitors		
	Task Detail Have students: 1. Identify capacitors and symbols 2. Make schematic drawing 3. Define terms 4. Test capacitors 5. Determine construction of capacitor	Demonstrate procedure Review safety precautions Assign tasks Supervise work Check students' progress	Assignment and Job Sheets: teacher prepared Materials and equipment necessary to perform task

MAJOR BLOCK IV ALTERNATING CURRENT CIRCUITS	TASK: 2. Compare Effect Of Alternating And Direct Current On Capacitors AIM: The student will be able to construct a circuit according to schematic and make comparison of the effects of alternating current and direct current on capacitor in the circuit.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Capacitance	Related Knowledge		
	I. Review major block IV, minor block C, task 1, for related information	Discuss lesson	Ref. #11 Ref. #6
	II. Comparison of resistance and capacitance A. Resistor 1. Controls flow of current 2. Places fixed amount of resistance B. Capacitor 1. Stores a charge 2. Opposes change in voltage	Illustrate capacitors in AC and DC circuit	
	III. Capacitors in DC circuit IV. Capacitors in AC circuit V. Phase relationship VI. Frequency VII. Reactance		
	Task Detail		
	1. Connect circuit according to schematic 2. With DC power supply on observe the effect on circuit 3. With AC power supply on observe 4. Compare the two observations	Demonstrate procedure Review safety precautions Assign tasks Supervise assignment Check students' progress	Assignment Sheet: teacher prepared Materials and equipment necessary to perform task

MAJOR BLOCK IV

ALTERNATING CURRENT CIRCUITS

TASK: 1. Determine Resonance In A Series RCL Circuit

AIM: The student will be able to define terms; identify symbols; explain technique used to calculate circuit values in series resistive and reactive circuits; and demonstrate ability to determine resonance in a series RCL circuit.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
RCL Circuits	Related Knowledge		
	I. Series RCL circuit	Reading assignment	Ref. #11
	A. Resistance	Pass out Information Sheet	Information Sheet: teacher prepared
	B. Inductance		
	C. Capacitance	Show transparencies	Transparencies: teacher prepared
	D. Current		
	II. Reactance	Discuss lesson and review relationship of voltage, impedance and resonance in a series RCL circuit	
	A. Definition		
	B. Symbol		
	C. Formulas		
	III. Impedance		
	A. Definition		
	B. Current lag		
	C. Current lead	Illustrate symbols	Chalkboard
	D. Symbol	Solve problems using formula	
	E. Formula		
	IV. Voltage and current		
	A. Across resistance	Have students:	
	B. Across inductor	1. Define terms	
	C. Across capacitor	2. Identify symbols	
	D. Reactive voltage	3. Solve problems	
	E. Formula		
	V. Resonance	Test	Test: teacher prepared
	A. Definition		
	B. Resonant frequency		
	C. Effects around resonance		
	D. Formula for resonant frequency		
	E. Uses for resonant circuit		
	F. Band width		
	VI. Tuned series RCL circuits		
	A. Inductance effect		
	1. Increase		
	2. Decrease		

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
RCL Circuits (continued)	Related Knowledge (cont'.) B. Capacitance effect 1. Increase 2. Decrease C. Filters 1. Types 2. Characteristics 3. Uses		
	Task Detail Suggested activities for student to perform are: 1. Construct series RCL circuit 2. Calculate voltage and current values 3. Use test equipment to determine resonance in a series RCL circuit	Demonstrate and explain assignment Assign tasks Supervise work Check students' performance	Job Sheet: teacher prepared Materials, equipment, and components necessary to perform task

MAJOR BLOCK IV

ALTERNATING CURRENT CIRCUITS

TASK: 2. Determine The Resonant Frequency Of An RCL Parallel Circuit

AIM: The student will be able to define terms; identify symbols; construct a parallel RCL circuit; calculate circuit values; and demonstrate ability to determine the resonant frequency of an RCL parallel circuit.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
RCL Circuits	Related Knowledge		
	I. Parallel RCL circuit	Reading assignment	Ref. #11
	A. Resistance	Passout: Information Sheet	Information Sheet: teacher prepared
	B. Capacitance	Show transparencies	
	C. Inductance	Discuss lesson	Transparencies: teacher
	D. Common voltage		
	E. Parameters	Explain relationship of frequency, impedance, and phase in a parallel RLC circuit	
	II. Resonance		
	A. Definition		
	B. Impedance value		
	C. Current value		
	D. Phase angle		
	E. Resonance frequency	Illustrate symbols	Chalkboard
	F. Effects		
	G. Uses for resonant circuits		
	H. Quality factor and band width		
	I. Formulas	Solve problems using formulas	
	1. Current		
	2. Impedance		
	3. Frequency response	Have students:	
	4. Power	1. Define terms	
	5. Resonant frequency	2. Identify symbols	
	6. Effects of resonance	3. Solve problems	
	7. Quality and band with	Test	Test: teacher prepared
	Task Detail		
	Suggested activities for student:	Demonstrate and explain assignment	Job Sheet: teacher prepared materials, equipment, and components necessary to perform job
	1. Construct parallel RLC circuit	Assign tasks	
	2. Calculate circuit values	Supervise work	
	3. Use test equipment to determine resonant frequency of an RLC parallel circuit	Check students' performance	

MAJOR BLOCK IV

ALTERNATING CURRENT CIRCUITS

TASK: Identify And Explain The Principles Of The Oscillator

AIM: The student will be able to identify the common types of oscillator circuits, the types of oscillators and their use, and methods of converting AC to DC and DC to AC.

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Oscillators	Related Knowledge		
	I. Oscillators function A. Continuous variable alternating current B. Pulsating direct current	Reading assignment Pass out Information Sheet	Ref. #11 Information Sheet: teacher prepared
	II. Terms A. Regenerative feedback B. Degenerative feedback C. Flywheel action D. Tank circuit E. Damped wire F. Continuous wave	Discuss lesson Compare operation of various type oscillators Demonstrate operation	
	III. Types of oscillators A. Hartley 1. Magnetic coupling for feedback 2. Operates same as tickler coil and transformer 3. Identified by tapped coil or autotransformer B. Colpitts 1. Principle function 2. Similar to Hartley 3. Split stator capacitor C. Crystal oscillators D. RC oscillators E. Multivibrator 1. Astable 2. Monostable 3. Flip-flop bistable	Show transparencies	Transparencies: teacher prepared

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Oscillators (continued)	Task Detail Have students build a practice oscillator	Demonstrate procedure and review Review safety precautions Assign task Supervise work Check students' work	Assignment Sheet: teacher prepared Materials and equipment necessary to perform task

MAJOR BLOCK V

SEMICONDUCTORS

TASK: 1. Physics of Semiconductors

AIM: The student will be able to describe the physics theory of semiconductors.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Semiconductor Theory	Related Knowledge		
	I. Review atomic structure	Reading assignment	Ref. #7
	A. Nucleus	Pass out Information Sheet	Information Sheet: teacher prepared
	B. Electrons	Discuss and review lesson	
	1. Shells	Illustrate on chalkboard	Chalkboard
	2. Electrostatic forces	Show and discuss film	Film: Brattain on Semiconductor Physics, Bell System Telephone Offices
	C. Charges		
	II. Electrical characteristics		
	A. Valence		
	B. Holes		
	III. Electron volt		
	IV. Energy level bands		
	A. Valence band		
	B. Conduction band		
	C. Forbidden band		
	V. Covalent bonding		
	A. Silicon		
	B. Germanium		
	VI. Intrensic semiconductor		
	A. Hole flow	Oral questions	
	B. Electron flow	Summarize	

MAJOR BLOCK V
SEMICONDUCTORS

TASK: 2. Theory of Semiconductor Function
AIM: The student will be able to relate theory of current flow in semiconductors.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Semiconductor Theory	Related Knowledge		
	I. Intrinsic conduction	Reading assignment	Ref. #7
	A. Mobility	Discuss and review lesson	
	B. Recombination		
	C. Lifetime		
	II. Doping		
	A. Impurity atoms	Show transparencies	Transparencies: teacher prepared
	B. Extrinsic semiconductor		
	C. Bulk resistance		
	D. Nontetravelent		
	III. N-type semiconductors	Illustrate	
	A. Negative charge		
	B. Electron donor		
	IV. P-type semiconductors	Summarize	
	A. Trivalent atoms	Test	Test: teacher prepared
	B. Electron acceptor		

MAJOR BLOCK V

SEMICONDUCTORS

TASK: 1. P-N Junction

AIM: The student will be able to describe the forming of semiconductor diodes and their function as rectifiers.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Diodes	Related Knowledge		
	I. P-N joining processes	Reading assignment	Ref. #7
	A. Alloy	Discuss and review lesson	
	B. Diffusion		
	C. Electrochemical		
	D. Epitaxial layer	Show film and discuss	Film: TF11-3047 Semiconductors and Semiconductor Diode, U.S. Army
	E. Growth junction		
	II. As rectifiers		
	A. Threshold voltage		
	1. Germanium 0.2	Demonstration	
	2. Silicon 0.6		
	B. Polarity	Show transparency	Transparency: teacher prepared
	1. Forward bias		
	2. Reverse bias		
	C. Avalanche	Pass out Information Sheet	Information Sheet: teacher prepared
	III. Characteristic curve		
	IV. Types of circuits	Chalkboard illustrations	Chalkboard
	A. Half-wave rectifier	Summarize	
	B. Full-wave	Quiz	
	C. Bridge rectifier		
	D. Half-wave with input filter		

MAJOR BLOCK V

SEMICONDUCTORS

TASK: 2. Diode Selection

AIM: The student will be able to interpret diode data sheets and select diodes for specific applications.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Diodes	Related Knowledge		
	I. Standard symbol	Reading assignment	Ref. #7
	A. Arrowhead and bar	Discuss and review lesson	
	B. Direction of current		
	1. Anode		
	2. Cathode		
	II. Type number - IN	Pass out Information Sheet	Information Sheet: teacher prepared
	A. Serial number		
	B. Color bands		
	III. Data sheet parameters	Illustrate symbols	
	A. Mechanical data		
	1. Package shape		
	2. Dimensions		
	B. Electrical characteristics		
	1. Peak reverse voltage		
	2. Peak inverse voltage		
	3. Reverse breakdown voltage		
	4. Steady-state forward current		
	5. Peak surge current	Oral questions	
	6. Static reverse current		
	7. Static forward voltage drop		
	8. Continuous power dissipation		

MAJOR BLOCK V

SEMICONDUCTORS

TASK: 3. Diode Types

AIM: The student will be able to describe other types of diodes and their applications.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Diodes	Related Knowledge		
	I. Zener diodes	Reading assignment	Ref. #15, Loper, D.E., Ahr, A.F., and Clendenning, L.R., Introduction to Electricity and Electronics, Delmar Publishers Inc., Albany, NY 12205
	A. Break-down voltage	Discuss and review lesson	
	B. As voltage regulator		
	C. Applications		
	II. Photosensitive diodes		
	A. Photovoltaic cell	Review	
	B. Solar cell	Summarize	
	C. Applications	Test	Test: teacher prepared

MAJOR BLOCK V

SEMICONDUCTORS

TASK: 1. Check Static Characteristics Of Transistors

AIM: The student will be able to set up test circuit for elementary check on transistors and sort as to basic types.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Transistors	Related Knowledge		
	I. Semi-conductor physics	Reading assignment	Ref. #16, Gerrish H. Howard H., and Duggar, W. E., Transistor Electronics, The Goodheart-Willcox Company, Inc., South Holland, IL 60473
	II. Application to transistors	Show and discuss film	
	III. The three basic electrodes and functions	O-H projector slide Chalkboard drawing	
	IV. Identifying electrode leads	Explanation	
	V. Difference between NPN and PNP transistors	Exhibit and discuss Summarize and discuss	Film: TF11-3046 Transistors, Part I, Introduction, Bell System Telephone Offices
	VI. Transistor symbols	Student assignment	
	VII. Effects of forward and reverse biasing	Oral questions Test	
	VIII. Runaway current	Discussion	Test: teacher prepared
	IX. Transistor packing		Film: Genesis of the Transistor, Bell System Telephone Offices
	Task Detail		
	1. Check NPN transistor (from base)	Demonstration	Assortment of NPN and PNP transistors; germanium and silicon
	2. Check PNP transistor (from base)		
	3. Record connections, polarity, and readings for each test	Discuss results	VOM (1½ volts and 1 ma. maximum when set on proper ohmmeter position)
	4. Compare polarities for conducting state		
	5. Assort unmarked transistors into NPN and PNP types	Show and discuss film	Film: TF11-3048, Transistors, Part III, NPN Transistors, U.S. Army
	6. Divide into germanium and silicone types	Summarize with questions Practice on task Review results Oral questions Performance test	Film: TF11-3049, Transistors, Part IV, PNP Transistors, U.S. Army

MAJOR BLOCK V

SEMICONDUCTORS

TASK: 2. Determine Most Useful Transistor Parameter

AIM: The student will be able to select suitable transistors for specific purposes.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Transistors	Related Knowledge		
	I. Circuit configurations	Illustration on chalkboard	Ref. #16
	A. Common emitter	Explanation	
	B. Common base	Examples on chalkboard	Chalkboard
	C. Common collector	O-H projectuals	
	II. Functions of each	Pass out Information Sheet	Information Sheet: teacher prepared
	III. Current gain		
	A. Alpha		
	B. Beta		
	IV. Circuits for measurements		
	A. Alpha		
	1. NPN		
	2. PNP		
	B. Beta		
	1. NPN		
	2. PNP		
	V. Rules for working with transistors		
	Task Detail		
	1. Arrange circuitry	Demonstration	Two micro-ammeters or suitable VOM's
	a. Alpha test for PNP		
	b. Beta test for PNP		1 ea. 100, 200, 10,000 ohm resistors
	2. Take readings and record	Discussion of results	
	3. Arrange circuitry	Task assignment	1 ea. 2-watt, 2,500 and 5,000 ohm potentiometers
	a. Alpha test for NPN	Practice on task	
	b. Beta test for NPN	Oral questions	2 ea. SPST switches
	4. Take readings and record	Performance test	Assortment of PNP and NPN transistors

MAJOR BLOCK V

SEMICONDUCTORS

TASK: 3. Plot Transistor Character Curves

AIM: The student will be able to set up apparatus and run curves for determining usefulness and operating points.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Transistors	Related Knowledge		
	I. Characteristic curves	Definition on chalkboard	Ref. #16
	A. Common emitter	Pass out Information Sheet	Information Sheet: teacher prepared
	B. Grounded base		
	II. Test circuitry		
	A. PNP	Show transparency	Transparency: teacher prepared
	B. NPN		
	III. Transistor data sheet	Explain and discuss	
	A. Description	Student assignment	
	B. Suggested applications	Drill on lesson	
	C. Mounting and heat sink	Oral questions	
	D. General data	Test	Test: teacher prepared
	1. Maximum voltage	Discussion	
	2. Maximum current		
	3. Maximum power		
	4. Maximum temperature		
	E. Suggested parameters and configurations		
	F. Static characteristic curves		
	1. Output curves		
	2. Input curves		
	G. Transistor biasing		
	1. Simple biasing circuit		
	2. Bias stabilization circuit		
	H. Load line		
	I. Graphical analysis		
	Task Detail		
	1. Check Vce-Ic characteristics	Demonstration	1½ and 6 volt sources
	a. Arrange circuit		2 microammeters or suitable VOM's
	b. Apply power		
	c. Start with Vce and Ib at		470 ohm resistor

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Transistors (continued)	Task Detail (cont'.) d. Record values of Ic for small steps of Vce e. Adjust Vce at zero f. Adjust Ib at 50 microamperes g. Record Ic h. Record value of Ic for each value of Vce, maintaining Ib at 50 microamperes i. Remove power 2. Check Veb-Ic characteristics a. Arrange circuitry b. Set Vce at zero c. Set Vcb at zero d. Adjust Vcb in small steps e. Record resulting values of Ic f. Adjust Vcb to zero g. Set and maintain Ic at 1 milliampere h. Record Ic i. Adjust Vcb in small steps j. Record resulting values of Ic		2 watt potentiometer 2 SPST switches Transistor 2N217 (or equivalent) with socket
	3. Repeat for Ic maintained at: a. 2 milliamperes b. 4 milliamperes c. 6 milliamperes d. 8 milliamperes e. 10 milliamperes f. 15 milliamperes g. 20 milliamperes 4. Turn power to OFF 5. Plot curves from data	Discussion of curved plotting Demonstration Student practice Summary and review Performance test Review Examination	Test: teacher prepared

MAJOR BLOCK V

SEMICONDUCTORS

TASK: 1. Field Effect Transistors And Integrated Circuits

AIM: The student will be able to describe characteristics of the FET and explain its operation.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Devices	Related Knowledge		
	I. Integrated circuit defined	Reading assignment	Ref. #7
	II. Field effect transistor	Brief description	
	A. Channel terminals	Discuss and review lesson	
	1. Drain	Pass out Information Sheet	Information Sheet: teacher prepared
	2. Source		
	3. Symmetry		
	B. Gates		
	1. Dual-gate		
	2. Single gate		
	III. Biasing	Illustrate transductance curve	
	IV. Drain characteristics		
	A. Short-gate		
	B. External bias		
	V. Transfer characteristics		
	VI. Data sheets	Oral questions	
	VII. Basic circuits	Demonstration	
	VIII. MOSFET's	Review	
	A. Symbols	Oral quiz	
	B. Function		

MAJOR BLOCK V

SEMICONDUCTORS

TASK: 2. Silicon Controlled Rectifier Devices

AIM: The student will be able to describe characteristics of the SCR and explain its operation.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Devices	Related Knowledge		
	I. SCR structure	Reading assignment	Ref. #15
	A. Terminals	Discuss and review lesson	
	1. Anode		
	2. Cathode	Pass out Information Sheet	Information Sheet: teacher prepared
	3. Gate		
	B. Integrated circuit		
	1. Transistors		
	2. Resistors		
	C. Operation	Chalkboard illustrations	Chalkboard
	II. 60 hertz specifications		
	A. Repetitive reverse voltage	Show transparency	Transparency: teacher prepared
	B. Forward blocking voltage		
	C. Forward current peak		
	D. Forward current average		
	E. Holding current		
	F. Gate signal current		
	III. Types and functions	Summarize	
	A. AC power control		
	B. Trigger diode		
	C. Triac		
	D. Diac		

MAJOR BLOCK V

SEMICONDUCTORS

TASK: 3. Physical Aspects Of Light

AIM: The student will be able to define light as a form of energy.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Devices	Related Knowledge		
	I. Solar energy	Reading assignment	Ref. #17, Masten, Larry B. and Billy R., Understanding Optronics, Texas Instruments Learning Center, P.O. Box 225012 MS 54, Dallas, Texas 75265, 1981
	II. Photon radiation	Discuss lesson	
	III. Wavelength and frequency	Illustrate	
	A. X-rays	Oral question	
	B. Invisible light		
	C. Visible light		
	IV. Color		
	V. Light measurement	Pass out Information Sheet	Information Sheet: teacher prepared
	A. Photometric system		
	B. Radiometric system		
	VI. Artificial light		
	A. Incandescent		
	B. Gas discharge		
	1. Fluorescent		
	2. Neon		
	3. Xeon		
	VII. Optoelectronics		
	A. Injection luminescence		
	1. VLED		
	2. LED		
	3. Liquid crystal display		
	B. Simulated emission		
	1. Maser - 1954		
	2. Laser - 1960		
	VIII. Considerations in source selection		
	A. Wavelength distribution		
	B. Viewing angle		
	C. Power efficiency		
	Task Detail		
	Set up task as resources permit		

MAJOR BLOCK V

SEMICONDUCTORS

TASK: 4. Light Detector Devices

AIM: The student will be able to name several types of light detectors and describe their functions.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Devices	Related Knowledge		
	I. Thermal detectors	Reading assignment	Ref. #17
	A. Thomson emf	Discuss and review lesson	
	B. Peltier emf		
	C. Seebeck emf	Pass out Information Sheet	Information Sheet: teacher prepareed
	II. Semiconductor review		
	A. P-type		
	B. N-type		
	III. Quantum detectors	Demonstrate	
	A. Photoresistive		
	B. Photovoltaic		
	C. Photoemissive		
	IV. Detector characteristics		
	A. Spectral response		
	B. Viewing angle		
	C. Efficiency		
	D. Electrical properties	Oral quiz	
	Task Detail		
	Set up task as resources permit		

MAJOR BLOCK V

SEMICONDUCTORS

TASK: 5. Optically Coupled Devices

AIM: The student will be able to describe how electronic systems are optically coupled.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Devices	Related Knowledge		
	I. Purpose of optical coupling	Reading assignment	Ref. #17
	A. Obtain information	Discuss and review lesson	
	B. Transfer information	Pass out Information Sheet	Information Sheet: teacher
	C. Solve problems		prepared
	II. Kinds of systems	Demonstration	
	A. Interruptive		
	1. Door openers		
	2. Burglar alarms		
	3. Bar code readers		
	B. Non-interruptive		
	1. Computer communication		
	2. Electrical isolation		
	III. Components		
	A. Light sources		
	1. Sun		
	2. Lamps		
	3. Light emitting diodes		
	4. Others		
	B. Detector		
	1. Eye		
	2. Silicon semiconductor		
	3. Others		
	C. Transfer media		
	1. Air		
	2. Electrical insulation		
	3. Windows		
	4. Lens		
	5. Filters		
	6. Mirrors		
	7. Prisms		
	8. Diffraction		
	9. Fiber optics		

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Devices (continued)	Related Knowledge (cont'.) IV. Important considerations A. Proper matching B. Transfer ratio C. Frequency response D. Isolation E. Noise immunity Task Detail Set up task as resources permit		

MAJOR BLOCK V

SEMICONDUCTORS

TASK: 6. Optoelectronic Communication Devices

AIM: The student will be able to describe the various types of electronic displays used to convey information.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Devices	Related Knowledge		
	I. Display characteristics	Reading assignment	Ref. #17
	A. Viewability	Discuss and review lesson	
	B. Response time		
	C. Power requirement	Pass out Information Sheet	Information Sheet: teacher prepared
	D. Reliability		
	E. Shock resistance		
	II. Display types	Demonstrate	
	A. Indicators	Show transparencies	Transparencies: teacher prepared
	1. Single lamp		
	2. VLED		
	B. Semiconductor numeric		
	1. Discrete VLED array		
	2. Seven segment		
	C. Semiconductor alphanumeric		
	1. 35 VLED		
	2. ASCII code		
	D. Liquid crystal		
	1. Advantages		
	2. Disadvantages		
	E. Gas discharge		
	1. Operation		
	2. Advantages		
	3. Disadvantages		
	F. Vacuum fluorescent		
	1. Operation		
	2. Advantages		
	3. Disadvantages		
	G. Electroluminescent		
	1. Operation		
	2. Advantages		
	3. Disadvantages		

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Devices	Related Knowledge (cont'.)		
(continued)	H. AC plasma 1. Operation 2. Advantages 3. Disadvantages		
	I. Cathode ray tube 1. Operation 2. Advantages 3. Disadvantages		
	J. Ink jet printer 1. Operation 2. Uses	Summarize Test	Test: teacher prepared
	III. Applications		
	Task Detail		
	Set up task as resources permit		

MAJOR BLOCK V
SEMICONDUCTORS

TASK: 7. Devices With Visible Light Emitting Diodes
AIM: The student will be able to describe and use light emitting diodes in displays.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Devices	Related Knowledge		
	I. VLED electro-optical characteristics	Discuss and review lesson List	Ref. #17 Manufacturer's data sheets
	II. Optical characteristics		
	III. Electrical characteristics		
	IV. Selection	Demonstaration	
	V. Applications		
	A. Indicators		
	1. Status		
	2. Logic level		
	3. Instrument panels		
	B. Other		
	1. Illumination	Summarize	
	2. Remote controls	Review	
	3. Voltage monitors	Test	Test: teacher prepared
	Task Detail		
	Set up task as resources permit		

MAJOR BLOCK VI DIGITAL ELECTRONICS	TASK: 1. Historical Development AIM: The student will be able to describe how digital electronics has evolved.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Introduction	Related Knowledge I. Abacus A. 4,000 years ago B. Asian countries C. Fast adding II. Mechanical calculation A. 1617 - John Napier 1. Published paper 2. Led to development of slide rule later B. 1642 - Blaise Pascal 1. First real adding machine 2. Made with wheels and gears C. Late 1600's - Gottfried Leibnitz 1. Advanced calculator 2. Four functions plus square roots III. Punched cards A. Early 1800's - Joseph Jacquard 1. First punched cards 2. Loom instructions B. 1835 - Charles Babbage 1. Analytical engine 2. Mathematical computer 3. Punched card program 4. Conditional transfer loops 5. Principles still used today	Discussion Demonstrate Oral questions List on chalkboard	Ref. # 3

MINOR BLOCK 4	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Introduction	Related Knowledge (cont'.)		
(continued)	C. 1890's - Herman Hollerith		
	1. IBM card		
	2. Coded punching sequence		
	3. First electrical machine	Oral quiz	

MAJOR BLOCK VI

DIGITAL ELECTRONICS

TASK: 2. Electro-Mechanical to Electronic

AIM: The student will be able to describe recent developments in digital electronics.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Introduction	Related Knowledge I. Electro-mechanical A. 1944 - Howard Aiken 1. Harvard University 2. First electro-mechanical computer B. Mark I 1. 51 feet long - 8 feet high 2. Paper tape instructions 3. Punched card input 4. Typed card record 5. Three second multiplier C. 1947 - Mark II 1. ¼ second multiplier 2. 12 times faster II. Electronic computers A. 1946 - ENIAC 1. University of Pennsylvania 2. Eckert and Mauchly 3. First electronic digital computer 4. Used vacuum tubes 5. 2.8 millisecond multiplier B. 1946 - Von Neumann 1. Parallel transfer idea 2. Stored program idea C. 1950 UNIVAC I 1. First mass-produced electronic computer	Discussion Lecture Question List on chalkboard	Ref. # 4

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Introduction (continued)	Related Knowledge (cont'.) 2. Same group as ENIAC 3. Vacuum tubes D. Since 1950 1. 1958 - Jack Kilby, Texas Instruments - integrated circuit 2. 1971 One-chip calculator 3. 1972 4-bit microcomputer on a chip 4. 1976 - 16-bit microprocessor 5. 1977 16-bit on a chip		

MAJOR BLOCK VI
DIGITAL
ELECTRONICS

TASK: 3. Analog to Digital
AIM: The student will be able to describe the differences between analog and digital electronics.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Introduction	Related Knowledge		
	I. Review integrated circuits	Reading assignment	Ref. # 5
	A. Linear or analog	Discussion	
	B. Digital		
	1. Advantages		
	2. Limitations		
	II. Digital integrated circuit		
	A. On or off		
	B. Yes or no		
	C. I or 0		
	III. Components		
	IV. Semiconductor chip	Summarize	
	V. Number systems	Quiz	

MAJOR BLOCK VI
DIGITAL
ELECTRONICS

TASK: 1. Basic Logic
AIM: The student will be able to determine proper components for use in basic logic circuits.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Logic Gates and Memory	Related Knowledge		
	I. IG logic block	Explanations	Ref. # 4
	II. Logic building blocks	Definitions on chalkboard	
	III. Resistor-transistor logic	Logic circuits on chalkboard	
	IV. AND logic	Truth tables on chalkboard	
	V. OR logic	Reading assignment	
	VI. NOT logic	Drill on lesson	
	VII. NOR logic	Oral questions	
	VIII. NAND logic	Test	
	IX. Truth tables	Discussion	
	X. Binary arithmetic		
	Task Detail		
	1. Connect up basic logic block and record output from each	Demonstration of task Discussion of task	
	2. Connect sine wave to square wave pulse converter	Task assignment Practice on task	
	3. Check output of each block with oscilloscope	Oral questions Performance test	
	4. Record waveforms at all signal points	Review Examination	

MAJOR BLOCK VI
DIGITAL
ELECTRONICS

TASK: 2. Memory Units
AIM: The student will be able to define types of memory units and describe their functions.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Logic Gates and Memory	Related Knowledge		
	I. NAND gate structure	Illustrate	Ref. # 4
	II. Flip-flop (static memory)	Discussion	
	A. R-S flip-flop		
	B. D (gate-latch) flip-flop		
	III. Dynamic memory cells (MDS)	List	
	IV. RAM's (Random access memory)		
	V. ROM (Read-only memory)	Oral questions	
	VI. PROM (Programmable read-only memory)		
	VII. EPROM (Erasable programmable read-only memory)		
	VIII. ESROM (Electrically alterable read-only memory)		
	IX. Arithmetic logic		
	A. Adder logic circuit	Summarize	
	B. Register transfer circuit	Quiz	
	X. Timing and control		
	Task Detail		
	Set up task as resources permit		

MAJOR BLOCK VI

DIGITAL ELECTRONICS

TASK: 1. Special Circuits

AIM: The student will be able to describe special circuits used in digital electroni systems.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Circuits	Related Knowledge		
	I. Arithmetic	Discussion	Ref. # 3
	II. Clock circuit		
	III. Manager circuits	List	
	A. Job manager	Illustrate	
	B. Memory manager		
	C. Process manager		
	D. I/O manager		
	E. Information manager		
	Task Detail		
	Set up task as resources permit		

MAJOR BLOCK VI

DIGITAL ELECTRONICS

TASK: 2. Computer Circuits

AIM: The student will be able to describe the function of special computer circuitry.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Circuits	Related Knowledge		
	I. Peripheral interface adapters II. Video display generator III. Address and data bus IV. Digital registers	Discussion Illustration	Ref. # 3
	Task Detail		
	Set up task as resources permit	Oral questions Review Major block test	

MAJOR BLOCK VII

ELECTRONIC SYSTEMS

TASK: 1. AM Radio

AIM: The student will be able to describe AM radio components and their functions.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Radio and Television	Related Knowledge		
	I. Radio antennas	Reading assignment	Ref. # 1
	A. Wave propagation	Discussion	
	B. Types		
	C. Impedance matching		
	II. AM receivers	Demonstration	
	A. Crystal		
	B. TRF		
	C. Superheterodyne		
	III. Receiver circuits		
	A. RF amplifier		
	B. Oscillator		
	C. Mixer		
	D. Converter		
	E. IF amplifier		
	F. Detector		
	G. AF amplifier		
	H. Speakers	Summarize	
	I. Power supply	Quiz	

MAJOR BLOCK VII ELECTRONIC SYSTEMS	TASK: 2. FM Radio AIM: The student will be able to describe basic FM radio components and their functions.		
MINOR BLOCK A	**INFORMATION & TASK DETAIL**	**SUGGESTIONS FOR TEACHING**	**REFERENCES & AIDS**
Radio and Television	Related Knowledge		
	I. FM transmission	Reading assignment	Ref. # 1
	II. FM reception	Discussion	
	III. Receiver circuits		
	A. RF amplifier	Demonstration	
	B. Oscillator		
	C. Mixer		
	D. Converter		
	E. IF amplifier		
	F. Limiter		
	G. FM detector		
	H. AFC circuits		
	I. AF amplifiers	Summarize	
	J. Power supplies	Quiz	

MAJOR BLOCK VII
ELECTRONIC SYSTEMS

TASK: 3. Television
AIM: The student will be able to describe fundamental TV components and their functions.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Radio and Television	Related Knowledge		
	I. Antennas and transmission lines	Reading assignment Discussion	Ref. # 2 Ref. # 1
	A. Wave propagation		
	B. Antenna types		
	C. Types of lines		
	D. Installation and orientation		
	E. Impedance matching	Demonstration	
	II. Transmission		
	A. Scanning		
	B. Camera tubes		
	C. Fundamentals		
	III. Receivers		
	A. Split sound		
	B. Intercarrier		
	C. Circuits		
	1. Tuner		
	2. IF amplifiers		
	3. Video detector amps		
	4. FM sound		
	5. Synchronization		
	6. Vertical		
	a. Oscillator		
	b. Output		
	7. Horizontal		
	a. AFC		
	b. Oscillator		
	c. Power amp		
	8. High voltage		
	9. Deflection		
	10. AGC	Review	
	11. Low voltage	Minor block quiz	

MAJOR BLOCK VII

ELECTRONIC SYSTEMS

TASK: 1. Radio Communication

AIM: The student will be able to describe how radio waves are used in person to person communication.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Communications	Related Knowledge		
	I. Oscillator/antenna system	Reading assignment	Ref. # 5
	A. CW-continuous wave	Discussion	
	B. Interrupted CW		
	C. Morse code		
	II. Amateur or HAM radio		
	A. Information		
	B. Licensing		
	III. Citizen's band radio	Demonstration	
	A. Established 1947		
	1. FCC - class D		
	2. 23 channels		
	B. Expanded 1976		
	1. 40 channels		
	2. 4 watt output		
	C. Types		
	1. Mobile		
	2. Base station		
	3. Walkie - talkie		
	D. Antenna selection	Chalkboard illustrations	

MAJOR BLOCK VII
ELECTRONIC
SYSTEMS

TASK: 2. Telephone
AIM: The student will be able to describe the basic components of an electronic telephone switching system.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Communications	Related Knowledge		
	I. Basic telephone system	Reading assignment	Ref. # 1
	A. Two-wire	Discussion	
	B. Four-wire		
	II. Transmission		
	A. Wires and cables	Chalkboard illustrations	
	B. Radio waves		
	C. Microwaves		
	D. Satellite		
	III. Basic network switching		
	A. Local		
	B. Extended area		
	IV. Electromechanical switching		
	A. Sequential system		
	B. Matrix system		
	V. Electronic switching		
	A. Advantages		
	B. Components		
	C. Frequency division multiplexing		
	D. Time division multiplexing	Review	

MAJOR BLOCK VII
ELECTRONIC
SYSTEMS

TASK: 3. Optronics - Physical Aspects
AIM: The student will be able to define light as a form of communication.

MINOR BLOCK B

Communications

INFORMATION & TASK DETAIL

Related Knowledge

I. Solar energy
II. Photon radiation
III. Wavelength and frequency
    A. X-rays
    B. Invisible light
    C. Visible light
IV. Color
V. Light measurement
    A. Photometric system
    B. Radiometric system
VI. Artificial light
    A. Incandescent
    B. Gas discharge
        1. Fluorescent
        2. Neon
        3. Xenon
VII. Optoelectronics
    A. Injection luminescence
        1. VLED
        2. LED
        3. Liquid crystal display
    B. Stimulated emission
        1. Maser - 1954
        2. Laser - 1960
VIII. Considerations in source selection
    A. Wavelength distribution
    B. Viewing angle
    C. Power efficiency

Task Detail

Set up task as resources permit

SUGGESTIONS FOR TEACHING

Discussion

Illustrate

Oral questions

REFERENCES & AIDS

Ref. # 17

MAJOR BLOCK VII
ELECTRONIC SYSTEMS

TASK: 4. Light Detectors
AIM: The student will be able to name several types of light detectors and describe their functions.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Communications	Related Knowledge		
	I. Thermal detectors	Discussion	Ref. # 13
	A. Thomson emf		
	B. Peltier emf		
	C. Seebeck emf		
	II. Semiconductor review		
	A. P-type		
	B. N-type		
	III. Quantum detectors	Demonstrate	
	A. Photoresistive		
	B. Photovoltaic		
	C. Photoemissive		
	IV. Detector characteristics		
	A. Spectral response		
	B. Viewing angle		
	C. Efficiency		
	D. Electrical properties	Oral quiz	
	Task Detail		
	Set up task as resources permit		

MAJOR BLOCK VII

ELECTRONIC SYSTEMS

TASK: 5. Optical Coupling

AIM: The student will be able to describe how electronic systems are optically coupled.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Communications	Related Knowledge		
	I. Purpose of optical coupling	Discussion	Ref. # 13
	A. Obtain information		
	B. Transfer information		
	C. Solve problems		
	II. Kinds of systems		
	A. Interruptive		
	1. Door openers	Demonstration	
	2. Burglar alarms		
	3. Bar code readers		
	B. Non-interruptive		
	1. Computer communication		
	2. Electrical isolation		
	III. Components		
	A. Light sources		
	1. Sun		
	2. Lamps		
	3. Light emitting diodes		
	4. Others		
	B. Detector		
	1. Eye		
	2. Silicon semiconductor		
	3. Others		
	C. Transfer media		
	1. Air		
	2. Electrical insulation		
	3. Windows		
	4. Lens		
	5. Filters		
	6. Mirrors		
	7. Prisms		
	8. Diffraction		
	9. Fiber optics		

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Communications (continued)	Related Knowledge (cont'.) VI. Important considerations A. Proper matching B. Transfer ratio C. Frequency response D. Isolation E. Noise immunity Task Detail Set up task as resources permit		

MAJOR BLOCK VII

ELECTRONIC SYSTEMS

TASK: 1. Computer System Components

AIM: The student will be able to describe the primary units of a computer and relate their purpose.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Computers	Related Knowledge		
	I. Central Processing Unit (CPU)	List	Ref. # 3
	A. Makes decisions	Discuss	
	B. Controls other units	Diagram	
	C. Collects and decodes information	Question/answer	
	D. Communicates with input/output (I/O)		
	II. Memory		
	A. Stores instructions		
	B. Stores data		
	III. Input/Output unit		
	A. Receives instruction		
	B. Communicates data to outside, memory, other systems, etc.		
	IV. Relay busses (16 wires)		
	A. Data bus		
	B. Address bus		
	C. Control bus		
	V. Accessory units		
	A. Auxillary storage	Summary	
	B. I/O processor		

MAJOR BLOCK VII
ELECTRONIC
SYSTEMS

TASK: 2. Systems
AIM: The student will be able to describe operating systems and their functions.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Computers	Related Knowledge		
	I. Purpose of operating system or monitor	Explanation	Ref. # 3
	II. Instructions to computer	List	
	A. Load and execute correct compiler	Discuss	
	B. Load machine instructions and begin		
	C. Direct final output to print or display		
	D. Terminate the job		
	III. Types of systems		
	A. For small computers		
	B. Large computers		
	1. Multiprogrammed		
	2. Time-sharing		
	3. Distributed processing		
	4. Resident monitor		
	5. Batch		
	IV. System managers		
	A. Job manager		
	1. Reads and places programs		
	2. Establishes control block		
	3. Checks priorities		
	4. Checks resources		
	5. Assigns resources		
	6. Executes job		
	B. Memory manager		
	1. Stores information		
	2. Retrieves information		

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Computers (continued)	Related Knowledge (cont'.) C. Processor manager 1. Assigns tasks to CPU 2. Synchronizes steps D. I/O manager 1. Maintains resource tables 2. Accepts input 3. Controls output E. Information manager		
	1. Stores data	Summarize	
	2. Locates and retrieves data	Quiz	
	Task Detail Set up task as resources permit		

MAJOR BLOCK VII
ELECTRONIC
SYSTEMS

TASK: 3. Computer Language
AIM: The student will be able to define the more popular computer languages and describe their advantages and disadvantages.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Computers	Related Knowledge		
	I. Conversing through codes	Discussion	Ref. # 1
	II. Interactive systems	Question/answer	
	III. Time sharing systems		
	IV. Expression evaluation		
	V. Subroutines	List	
	VI. BASIC		
	A. Development		
	B. Advantages		
	C. Disadvantages		
	VII. Pascal		
	A. Advantages		
	B. Disadvantages		
	VIII. FORTRAN		
	A. Advantages		
	B. Disadvantages		
	IX. PL/I		
	A. New language	Oral quiz	
	B. Advantages		
	Task Detail		
	Set up task as resources permit		

MAJOR BLOCK VII

ELECTRONIC SYSTEMS

TASK: 4. Programming

AIM: The student will be able to describe the steps in developing a computer program.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Computers	Related Knowledge		
	I. Program considerations	List	Ref. # 3
	A. Cost	Discussion	
	B. Size		
	C. Storage requirements		
	D. Time		
	E. Flexibility and reliability	Explain	
	F. Maintenance		
	II. Steps in programming		
	A. Define problem		
	1. Written description		
	2. List procedure	Illustrate on chalkboard	
	B. Develop flow chart		
	1. Bottom up		
	2. Top down		
	3. Flow chart symbols		
	C. Code program		
	1. Punched cards		
	2. Tape or disc		
	3. Language selection		
	4. Instructions		
	D. Translation		
	1. Mnemonics		
	2. Assembler		
	3. Compiler		
	E. Testing		
	1. Simple problem		
	2. Complex problem	Oral quiz	
	Task Detail		
	Set up task as resources permit		

MAJOR BLOCK VIII
ELECTRONIC CIRCUITS

TASK: 1. Review Power and Relationships
AIM: The student will be able to relate power relationships in electronic circuitry.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Power Supplies	Related Knowledge		
	I. Review power relationships	Reading assignment	Major Block III
	A. Voltage	Discussion	
	B. Current		
	C. Resistance		
	II. Power formulas		
	III. Circuit calculations		
	IV. Combination circuits		
	V Power sources	Summarize	

MAJOR BLOCK VIII
ELECTRONIC CIRCUITS

TASK: 2. Applications of Rectifier Circuits
AIM: The student will be able to analyze rectifier requirements to determine proper rectifier and to properly install rectifier.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Power Supplies	Related Knowledge		
	I. Principles of rectification	Illustration on chalkboard	Ref. # 1
	II. Types of rectifiers	Explanation	
	III. Common rectifier circuits	Display	
	A. Half-wave	Explain operation	
	B. Full-wave	Student assignment	
	C. Bridge	Explain with chalkboard illustrations	
	D. Doubler		
	E. Tripler	Drill on lesson	
	F. Quadrupler		
	Task Detail		
	1. Select type of rectifier unit	Demonstration of task	Assortment of rectifier units
	2. Determine cathode and anode terminals		Transformer previously rewound
	3. Determine polarity from schematic	Discussion	Suitable load resistor
	4. Install rectifier for proper polarity	Task assignment Practice on task	VOM
	5. Apply power to transformer	Oral questions	
	6. Test output	Performance test	
	7. Record results		

MAJOR BLOCK VIII

ELECTRONIC CIRCUITS

TASK: 3. Install Filter Circuit

AIM: The student will be able to select units, assemble, install and evaluate filter performance.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Power Supplies	Related Knowledge		
	I. Types of filter circuits	Explain and discuss	Ref. # 1
	II. Characteristics of various types	Examples on chalkboard	
	III. Evaluation requirements	Invite and answer questions	
	IV. Use of charts and nomographs	Student assignment Oral questions Test Discussion	
	Task Detail		
	1. Determine requirements	Demonstration	Assorted filter components
	2. Select proper filter components		Power supply load resistors
	3. Install as per circuit		VOM
	4. Test without power		Oscilloscope
	5. Check voltage output with various loads	Discussion Task assignment	Graph paper
	6. Monitor waveform	Practice on task	
	7. Determine percent of ripple for each load	Oral questions Performance test	
	8. Plot graph of voltage and load		
	9. Plot graph of load and percent ripple		

MAJOR BLOCK VIII
ELECTRONIC CIRCUITS

TASK: 4. Install Voltage Divider Circuit
AIM: The student will be able to calculate values and sizes of components for specified needs and install.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Power Supplies	Related Knowledge		
	I. Uses for the voltage divider	List on chalkboard and discuss	Ref. # 1
	II. Types of divider circuits	Work example problems	
	III. Calculations	Student assignment	
	IV. Use of zener diode regulators	Drill on lesson	
	V. Use of gas-type regulator tubes	Oral questions	
		Test	
		Discussion	
	Task Detail		
	1. Turn power supply to ON	Demonstrate	Filtered power supply
	2. Measure output voltage		Assortment of bleeder resistors
	3. Connect voltage divider selected		VOM
	4. Observe new voltage		Oscilloscope
	5. Check voltage at taps	Discussion of results	Load resistors
	6. Load taps	Student task assignment	
	7. Recheck voltage at taps	Review results	
	8. Observe waveform	Performance test	
	9. Record results		

MAJOR BLOCK VIII
ELECTRONIC CIRCUITS

TASK: 5. Construct A Complete Power Supply

AIM: The student will be able to select the appropriate circuitry and construct a power supply to specifications.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Power Supplies	Related Knowledge		
	I. Circuit design or selection	Illustration	Ref. # 3
	II. Chassis and cabinet	Calculations	
	III. Metal fabrication	Discussion	
	IV. Assembly procedures	Reading assignment	
	A. Parts	Student reports on assignments	
	B. Wiring	Discussion and questions	
	V. Testing	Test	
	A. Power OFF	Discussion	
	B. Power ON		
	Task Detail		
	1. Layout chassis		
	2. Cut and drill holes		
	3. Bend to proper shape and size		
	4. Layout panel		
	5. Cut and drill holes		
	6. Apply finish as desired		
	7. Assemble panel to chassis		
	8. Mount other parts (except transistors)		
	9. Wire all parts		
	10. Check out wiring		
	a. Visually		
	b. Ohmmeter		
	11. Install transistors (or tubes)		
	12. Test and evaluate		

MAJOR BLOCK VIII
ELECTRONIC CIRCUITS

TASK: 6. Troubleshoot Power Supply
AIM: The student will be able to test components of power supply and make necessary repairs.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Power Supplies	Related Knowledge		
	I. Operational theory	Explanation	Ref. # 3
	II. Normal-state test	Illustration	
	III. Common defects	Reading assignments	
	IV. Resistance (no power) tests	Students report on assignments	
	V. Protection procedures	Student led discussion	
	A. Ballast lamp	Oral questions	
	B. Variable transformer	Test	
	VI. Voltage and current tests	Discussion	
	Task Detail		
	1. Power OFF	Demonstration	VOM, VTVM
	2. Check commonly defective parts		Capacitor bridge Ballast bulb, 300 watts or variable transformer
	3. Test-point measurements		
	4. Power ON, reduced voltage		Oscilloscope
	5. Voltmeter tests		Schematic diagram
	6. Test with full power	Discussion	Defective power supply
	7. Connect load	Task assignment	Suitable load
	8. Oscilloscope checks	Practice on task	
	9. Replace defective part when necessary	Oral questions Performance test	Film: TF 11-2851, *Fundamentals of Radio Troubleshooting, Part I, Principle Technique,* U.S. Army
	10. Put in service and check operation	Show and discuss film	

MAJOR BLOCK VIII

ELECTRONIC CIRCUITS

TASK: 1. Breadboard Model of Common-Emitter Amplifier

AIM: The student will be able to set up common-emitter amplifier with proper bias and stabilization.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Amplifiers	Related Knowledge		
	I. Amplifier configurations II. Proper type transistor III. Selection of most suitable transistor IV. Common-emitter amplifier circuit V. Amplifier operation VI. Biasing techniques VII. Circuit stabilization	Discuss data sheets Diagram on chalkboard Explanation Illustration Reading assignment Drill on lesson Quiz Discussion	Ref. # 5
	Task Detail		
	1. Connect-up common-emitter amplifier a. Connect w/o stabilization b. Check circuit and all polarities c. Apply power d. Observe 1.) Input signal 2.) Output signal e. Hold hot soldering iron or lamp near transistor	Demonstrate	6 volt DC source Oscilloscope VOM (20,000 ohm and volts) Audio generator Resistors, 220, 390, 470, 1k, 4, 7k, 10k, 68k ohm Capacitors, 5 mfd, 25v, to 25 mfd, 6v SPST 5,000 ohm, 2 watt potentiometer
	f. Observe 1.) No-heat signal output 2.) Output with heat 3.) Charge in collector current 2. Record results 3. Reconnect with stabilization circuit 4. Repeat Id and Ig above 5. Record results	Discussion Task assignment Practice on assignment Oral questions	Semiconductor: 2N217 or equivalent, 1N34 diode or equivalent

MAJOR BLOCK VIII ELECTRONIC CIRCUITS	TASK: 2. Maximum-Dissipation Curve AIM: The student will be able to predict the operating conditions of an amplifier and adjust for optimum performance.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Amplifiers	Related Knowledge		
	I. Meaning of "load-line"	O-H projecturals	Ref. # 5
	II. Uses of the load-line	Explanation	
	III. Collectors dissipation curves	Illustration	
	IV. D-C load-line	Reading assignment	
	V. Predicting amplifier characteristics	Drill on lesson Oral questions	
	Task Detail		
	1. Set up common-emitter amplifier circuit	Demonstrate	Variable, regulated D-C source
	2. Set bias at cut-off of Ic		VTVM
	3. Close SW, adjust Ib to .1 ma		0-1 ma: 0-50 ma. D.C. milliammeters
	4. Record Ib, Ic, Vce, Veb		
	5. Repeat for Ib set at: a. .2ma. b. .3ma. c. .4ma.		100 and 1,000 ohm resistors 2N217 transistor or equivalent
	6. Compute collector current gain a. Ib = .2ma. b. Ib = .4ma.	Discussion of results	SPST switch 50,000 ohm, 2 watt potentiometer
	7. Graph and plot "load-lines"	Student assignment Practice on assignment Review and summary Performance test	

MAJOR BLOCK VIII

ELECTRONIC CIRCUITS

TASK: 3. Impedance

AIM: The student will be able to experimentally determine impedance values of an amplifier.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Amplifiers	Related Knowledge I. Meaning of impedance II. Input impedance III. Output impedance IV. Methods for determining impedance V. Applications	Explanation Illustration Reading assignment Drill on lesson Oral questions Test Discussion	Ref. # 6
	Task Detail 1. Measure input impedance a. Modify circuit b. Apply power c. Feed moderate signal to input d. Determine input impedance 1.) Input current-voltage method 2.) Voltmeter-ohmmeter method e. Remove emitter resistor by pass capacitor f. Re-evaluate input impedance g. Record results 2. Measure output impedance a. Modify circuit for measuring output impedance b. Apply power c. Adjust for moderate output signal d. Read output voltage with no load	Demonstration of task Discussion Ask questions Task assignment Practice on task Oral questions Performance test	

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Amplifiers (continued)	Task Detail (cont'.) e. Insert adjustable load resistor f. Adjust until voltage output is one-half that with no load g. Remove resistor and measure its resistance h. Record as output impedance		

MAJOR BLOCK VIII

ELECTRONIC CIRCUITS

TASK: 4. Amplifier Gain and Phase Relationships

AIM: The student will be able to determine voltage gain, power gain, and phase relationships of an amplifier.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Amplifiers	Related Knowledge		
	I. Meaning of voltage	Define on chalkboard	Ref. # 4
	II. Mathematical calculations	Give examples	
	III. Applications	Explanation	
	IV. Meaning of "power gain"	Reading assignment	
	V. Mathematical calculations	Drill on lesson	
	VI. Applications	Oral questions	
	VII. Value of experimental gain measurements	Quiz Discussion	
	Task Detail		
	1. Connect up transistor amplifier	Demonstration procedures	
	2. Apply power	Ask and invite questions	
	3. Inject 100 HZ sine wave	Task assignment	
	4. Set for undistorted output	Practice on task	
	5. Measure output voltage	Oral questions	
	6. Measure input voltage	Performance test	
	7. Calculate ratio		
	8. Record as voltage gain		
	9. Calculate output power		
	10. Calculate input power		
	11. Calculate power gain		
	12. Record results		
	13. Determine phase relationships a. Emitter to base b. Emitter to controller		
	14. Record results		

MAJOR BLOCK IX
MICROCOMPUTER
REPAIR

TASK: 1. Microcomputer Block Diagram
AIM: The student will be able to follow the data path through the computer and identify each particular section and its function.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Introduction	Related Knowledge		
	I. Central Processing Unit (CPU) A. Arithmetic B. Clock/control unit C. Memory 1. Primary memory 2. Secondary memory D. Input/output 1. Analog digital converter (input)	Review Major Block VII, Minor Block C, Tasks 1, 2, and 3 Lecture and discuss lesson	Ref. #18, Stephenson, John G. and Cahill, Bob, How to Maintain and Service Your Small Computer, Howard W. Sams, and Company, Inc. 4300 West 62nd St., Indianapolis, IN 46268
	2. Digital analog converter (output) II. Random Access Memory (RAM) A. Words "written" (stored) B. Words "read" (recovered) C. Order is at random III. Read Only Memory (ROM) A. Data permanently stored B. Connections C. PROM - Programmable Read-Only-Memory D. EPROM - Erasable Programmable Read-Only-Memory	Pass out: Information Sheet Illustrate and explain block diagram: 1. Chalkboard 2. Transparencies 3. Break down small computer 4. Computer manuals Define and explain terms and definitions	Ref. #19, Margolis, Art, Troubleshooting and Repairing Personal Computers, TAB/Books Inc., Blue Ridge Summit, PA 17214 Information Sheet: teacher prepared Chalkboard Transparencies: teacher prepared Small computer Manufacturer's manual
	E. EAROM - Electrically Alerable Read-Only-Memory IV. Busses A. Address bus 1. Function 2. Structure 3. Connections		Ref. #21, Technical Education Reserach Center-Southwest, Microcomputer Hardware, 4800 Lakewood Drive - Suite S, Waco, TX 76710

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Introduction	Related Knowledge (cont'.)		
(Continued)	B. Data Bus 1. Function 2. Structure 3. Connections		
	Task Detail		
	1. Have students draw and label microcomputer block diagram	Demonstrate and explain functions Assign task Check student's work	

MAJOR BLOCK IX

MICROCOMPUTER REPAIR

TASK: 2. Power Supply

AIM: The student will be able to troubleshoot the power supply system of a microcomputer.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Introduction	Related Knowledge I. Reset circuit II. Fuse and transformer III. Voltage regulators IV. Filters V. Waveforms	Reading assignment Lecture and discuss lesson Pass out: Information Sheet Review power supply Demonstrate procedure for troubleshooting power supply	Ref. #18 and Ref #19, "Troubleshooting Power Supplies" Ref. #20, Gaylord, Winston D., The Apple II Circuit Description, Howard W. Sams, 4300 West 62nd St., Indianapolis, IN 46206 Information Sheet: teacher prepared Ref. #21
	Task Detail Have students troubleshoot the power supply	Demonstrate procedure Review lesson Assign task Supervise assignment Check student's performance	Materials and equipment necessary to perform task

MAJOR BLOCK IX

MICROCOMPUTER REPAIR

TASK: 3. The Monitor or Video System
AIM: The student will be able to inspect and troubleshoot the monitor system.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Introduction	Related Knowledge		
	I. Purpose	Assigned reading	Ref. #20, Chapter 4
	II. Composite video signal	Lecture and discuss lesson	Ref. #1
	III. Interfacing	Pass out: Information Sheet	Ref. #2, Chapter 21
	IV. Contrast and brightness	Makeup of composite video signal	Ref. #21
	V. Vertical and horizontal syncro pulses		
	VI. Color signal		
	VII. Scope		

MAJOR BLOCK IX

MICROCOMPUTER REPAIR

TASK: 1. Function and Application of Measuring Devices

AIM: The student will be able to identify the function of and properly use the correct measuring device in testing and troubleshooting computers.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Measuring Devices	Related Knowledge I. Digital probe A. Function B. Operation C. Application II. Digital and analog meters A. Function B. Operation C. Application III. Line monitors A. Function B. Operation C. Application IV. Digital logic pulser A. Function B. Operation C. Application	Reading assignment Pass out: Information Sheet Demonstrate and review different measuring devices and their application in troubleshooting computer problems	Ref. #18, Chapter 5 Information Sheet: teacher prepared Ref. #21 Manufacturer's manual
	Task Detail Have students perform lab experiment if equipment is available	Demonstrate and review assignment Assign task Supervise student's work Check student's progress	Assignment Sheet: teacher prepared

MAJOR BLOCK IX
MICROCOMPUTER
REPAIR

TASK: 2. Oscilloscopes

AIM: The student will be able to demonstrate knowledge of the oscilloscope by identifying the basic functions of major circuits and controls, and by performing a diagnosis of the circuit.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Measuring Devices	Related Knowledge		
	I. Types	Reading assignment	Ref. #18, Chapter 5
	A. Dual trace		Ref. #20, "Wave Forms"
	B. Quad trace		Ref. #21
	II. Controls		Manufacturer's manual
	A. Cathode Ray Tube (CRT)	Pass out: Information Sheet	Information Sheet: teacher prepared
	B. Control knobs		
	C. Control switches	Discuss lesson and review:	
	III. Interpretation of wave form	1. Use of oscilloscope	
	IV. Voltage measurement	2. Use of schematic wave forms	
	A. Magnitude	3. Interpretation of wave forms	
	B. Polarity	4. Calibration of oscilloscope	
	C. A.C.		
	D. D.C.	Test over measuring devices	Test: teacher prepared
	V. Probe		
	A. Function		
	B. Type		
	C. Probe adjust		
	D. Probe compensation		
	Task Detail		
	Have students perform experiment using the oscilloscope to perform diagnosis	Demonstrate and review task Assign experiment Supervise work Check student's progress	Assignment Sheet: teacher prepared

MAJOR BLOCK IX MICROCOMPUTER REPAIR	TASK: 1. Clean and Lubricate Computer Parts AIM: The student will be able to identify types of cleaning chemicals and lubricants used in the maintenance of computers.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Care and Maintenance	Related Knowledge		
	I. Opening the computer II. Oily cleaners and lubricants A. Types B. Application III. Non-oily cleaners A. Types	Assigned reading Review and discuss lesson Refer to manufacturer's catalogs and specifications listed	Ref. #18, Chapter 5 Ref. #19, page 24 Ref. #21 Manufacturer's manual
	B. Application IV. Head cleaners A. Types B. Application V. Static sprays A. Types B. Static protections	Pass out: Information Sheet Emphasize safety precautions	Information Sheet: teacher prepared
	1. Static bracelets 2. Grounding procedures 3. Static free floor mats 4. Integrated Circuit (I.C.) precautions 5. Extracting procedures VI. Safety precautions	Demonstrate 1. Selection of cleaning agent 2. Lubrication 3. Proper procedures 4. Types of cleaning and lubricating materials	Samples
	Task Detail		
	Have students: 1. Select cleaning agent and lubricant 2. Properly clean and service computer	Demonstrate and review Emphasize safety procedures Assign task Supervise work	Assignment Sheet: teacher prepared Materials and equipment necessary to perform assigned task

MAJOR BLOCK IX

MICROCOMPUTER

REPAIR

TASK: 2. Remove and Replace Electronic Connections

AIM: The student will be able to perform diagnosis of computer and remove and replace inoperable connections.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Care and Maintenance	Related Knowledge		
	I. Soldering equipment and procedure - Refer to: Major Block II, Minor Block C, Tasks 1 and 2	Review soldering procedures: 1. Tools 2. Soldering 3. De-soldering	Ref. #18, Chapter 5 Ref. #19, Chapter 7 Ref. #11 Ref. #21
	II. I.C. removers and inserters III. Wire strippers A. Scissor type B. Plier type C. Automatic IV. Circular spring clips		
	V. Circuit board vise	Test over "Care and Maintenarce"	Test: teacher prepared
	Task Detail		
	Have students perform diagnosis of system and remove and replace inoperable connection	Demonstrate and review Assign task Emphasize safety Supervise lesson Check student's work	Assignment Sheet: teacher prepared Materials and equipment necessary to perform task

MAJOR BLOCK IX
MICROCOMPUTER
REPAIR

TASK: 1. Memory Circuits
AIM: The student will be able to identify the different memory circuits and their function.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Computer Circuits	Related Knowledge		
	I. Memory system	Assigned reading	Ref. #19
	A. Function		Ref. #18
	B. Primary memory		Ref. #21
	C. Secondary memory	Pass out: Information Sheet	Information Sheet: teacher prepared
	D. Information storage		
	1. Varies with computer	Lecture and discuss lesson	
	2. Indicated by bytes (4,8,12,16)		
	II. Random Access Memory (RAM)	Illustrate	
	A. Function		
	B. Can be altered		
	III. Read Only Memory (ROM)		
	A. Function	Refer to technical manuals	Manufacturer's manual
	B. Cannot be altered		Ref. #20
	C. Types		
	1. PROM		
	2. EPROM		
	3. EAROM		
	IV. Use of technical manuals		
	Task Detail		
	Have students utilize manuals for obtaining information and specifications		
	Set up task as resources permit		

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MAJOR BLOCK IX
MICROCOMPUTER
REPAIR

TASK: 2. System Timing Circuits
AIM: The student will be able to identify the function of the timing circuit and read and interpret clock signals with a scope.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Computer Circuits	Related Knowledge		
	I. Clock circuit	Assigned reading	Ref. #18, p. 151
	A. Function		Ref. #19, Chapter 13
	B. Types		Ref. #20, Chapter 3
	C. Frequencies	Pass out: Information Sheet	Information Sheet: teacher prepared
	II. Clock test		
	A. Dual trace scope	Discuss lesson	Ref. #21
	B. Minimum frequency response	Ask questions	
	C. Procedure	Demonstrate reading and interpretation of clock signals with scope	
	Task Detail		
	Have students perform lab experiment as resources permit	Demonstrate and review task Emphasize safety	Assignment Sheet: teacher prepared
	1. Examine operation of IC and test output with VOM	Assign task Supervise work	
	2. Check results against truth tables	Check student's work	

MAJOR BLOCK IX
MICROCOMPUTER
REPAIR

TASK: 3. System Busses
AIM: The student will be able to identify the principal busses of the system and their function.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Computer Circuits	Related Knowledge		
	I. Function of busses	Assigned reading	Ref. #19, Chapter 2
	A. Control operation of system		Ref. #20, Chapter 2 Ref. #21
	B. Controls function to be performed	Pass out: Information Sheet	Information Sheet: teacher prepared
	1. Locates		
	2. Instructs	Discuss and review lesson	
	3. Data		
	II. Structure		
	A. Two or more conductors		
	B. Coupled to system		
	C. Multiple wires		
	III. Principal types		
	A. Address Bus		
	1. Carry signals		
	2. Locates information		
	3. Contains 8 or 16 separate lines		
	B. Data bus		
	1. Total 8 lines		
	2. Carry instructions and data		
	3. May be bidirectional		
	4. Dedicated to specific function		
	IV. Types of bussing systems		
	A. Bus connectors		
	B. Bus pins		
	C. Comparison of systems		
	V. Motherboard		
	A. Printed circuit board		
	B. Contains connectors		
	C. Bussing scheme		

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Computer Circuits (continued)	Task Detail Have students identify system busses Assign lab task as equipment and resources permit		

MAJOR BLOCK IX
MICROCOMPUTER
REPAIR

TASK: 4. Video Display Generator

AIM: The student will be able to identify the function of the video display generator, its operation, relationship between the keyboard and monitor, and method of making a VDG test.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Computer Circuits	Related Knowledge		
	I. Video display generator	Assigned reading	Ref. #19, Chapter 17
	A. Function	Lecture and discuss lesson	Ref. #3, Chapter 2
	B. Character set	Pass out: Information Sheet	Information Sheet: teacher perpared
	C. Character generator		
	II. Typical VDG inputs		
	A. Random Access Memory (RAM)	Show transparency	Transparencies: teacher prepared
	B. Peripheral Interface Adapter (PIA)	Illustrate schematic of VDG	Chalkboard
	III. VDG video output		
	IV. Modes	Explain:	
	A. Alphanumeric inverted	1. Relationship of VDG, keyboard and monitor	
	B. Alphanumeric non-inverted		
	C. Semigraphics	2. How the keyboard and monitor are interfaced to mother board	
	D. True graphics		
	V. Keyboard		
	VI. Monitor	3. Various modes	
	VII. VDG test		
	A. Input-output tests		
	B. Use of test chart		
	Task Detail		
	Have students test VDG input-output as resources permit		

MAJOR BLOCK IX
MICROCOMPUTER
REPAIR

TASK: 5. Peripheral Interface Adapters (PIA)

AIM: The student will be able to explain the function of the PIA , identify the types and characteristics, and test the PIA pins and compare to the service check out chart

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Special Computer Circuits	Related Knowledge I. Function of the Peripheral Interface Adapter (PIA) A. Connects external device 1. Input 2. Input-output 3. Output B. Interfaces keyboard to data lines II. Types III. Characteristics IV. Use of technical manual	Assigned reading Review and discuss lesson Demonstrate use of technical manual in looking up specifications Illustrate use of service check out chart Show transparency	Ref. #19, Chapter 4, 15 Ref. #22, Bennett, W.S., and Evert, Carl F., What Every Engineer Should Know About Microcomputers, Hardware/Software Design, A Step By Step Example, Motorola
	Task Detail Have students: 1. Read voltages on PIA pins 2. Compare reading to service check out chart	Demonstrate task Explain procedures and observations Assign task Supervise student work Check progress	Assignment Sheet: teacher prepared

MAJOR BLOCK IX MICROCOMPUTER REPAIR	TASK: 6. Registers AIM: The student will be able to identify the types of registers; explain the function; explain the jobs performed; and explain the procedures for troubleshooting register problems.		
MINOR BLOCK D	**INFORMATION & TASK DETAIL**	**SUGGESTIONS FOR TEACHING**	**REFERENCES & AIDS**
Special Computer Circuits	Related Knowledge I. Register A. Temporary storage for digital information	Assigned reading Pass out: Information Sheet	Ref. #19, Chapter 10 Information Sheet: teacher prepared
	B. Combination of flip-flops and NAND gates	Review and discuss lesson Illustrate difference in types of registers	Ref. #18, Chapter 7
	C. Hold 4,8, or 16 bits D. Difference between gate and register	Show transparency	Transparency: teacher prepared
	II. Jobs performed A. Clear and complement B. Increment and decrement C. Shift bits D. Adding and oring E. Count III. Shift registers A. Parallel B. Serial C. Series/in-parallel out		Ref. #20, pages 111, 126
	IV. Troubleshooting	Discuss and demonstrate problems and methods of troubleshooting	Ref. #23, Chapter 8
	Task Detail Assign lab task as equipment and resources permit		

MAJOR BLOCK IX MICROCOMPUTER REPAIR	TASK: 1. Troubleshooting Tests and Procedures AIM: The student will be able to diagnose the problems and follow proper procedure in performing tests to solve repair problems.

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Troubleshooting the Microcomputer	Related Knowledge		
	I. Microcomputer system	Assigned reading	Ref. #18, Chapters 6, 7, 10, and 12
	A. System level	Review the computer system for localizing problems	
	1. Computer		
	2. Disk drive		Transparency: teacher prepared
	3. Modem	Show transparency	
	4. Printer	Illustrate system	Chalkboard
	B. Sub-system		
	1. RAM		
	2. ROM		
	3. Interface		
	4. CPU		
	5. Power supply		
	C. Component level		
	1. Transformer		
	2. Regulator		
	3. Rectifier		
	4. Fuse		
	5. Filters		
	6. Resistors		
	7. Capacitors		
	II. Common symptoms	Review common symptoms and possible causes	Ref. #18, Appendix E, "Troubleshooting Chart"
	A. Computer correctly starts, but stops		
	B. Computer makes random errors,		
	C. Garbage on screen		
	D. No response to commands		
	III. Tests	Demonstrate diagnosis of service problems	
	A. Key signals on CPU		
	1. Clock signal	Demonstrate use of diagnostic diskettes	
	2. Reset system		
	3. Data and address lines	Note: Reference made for Apple II, II Plus and IIe	
	4. Other circuits		
	B. Keyboard		
	1. Characters do not appear	Explain how the diagnostic diskettes work	Apple II and II Plus, Sams Computer Facts CC-1
	2. Multiple characters	Use schematic if available	

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Troubleshooting the Microcomputer (continued)	Related Knowledge (cont'.) IV. Procedure A. Identify symptom B. Perform task Task Detail Set up lab assignment as resources permit		

MAJOR BLOCK IX
MICROCOMPUTER
REPAIR

TASK: 2. Troubleshoot Monitor Problems
AIM: The student will be able to safely diagnose monitor problems and make proper corrections.

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Troubleshooting the Microcomputer	Related Knowledge		
	I. Safety A. High voltage B. Equipment C. Understanding of monitor	Assigned reading	Ref. #18, Chapter 11 and Appendix E Ref. #19, Chapter 21 (The Video Display)
	II. Voltage A. Low voltage B. High voltage C. Inspection D. Replacement	Pass out: Information Sheet Show transparency Demonstrate and review striping down the monitor	Information Sheet: teacher prepared Transparency: teacher prepared
	III. Wave forms A. Horizontal B. Vertical C. Black level setting	Demonstrate use of test equipment in making tests Note: Stress safety precautions	
	IV. Cathode Ray Tube (CRT)	Apply use of schematic diagrams	Chalkboard
	V. Optoisolator in drive circuits VI. Tuner contacts VII. RAM test VIII. Schematic and circuit tracings	Explain: 1. Compose video signal 2. Vertical and horizontal synchronizing pulses	Sams Computer facts CC-1 for Apple II and II Plus Howard W. Sams, 4300 West 62nd St., Indianapolis, IN 46206
	Task Detail Set up lab assignments as resources permit		

MAJOR BLOCK IX
MICROCOMPUTER
REPAIR

TASK: 3. Troubleshoot Power Supply Problems
AIM: The student will be able to troubleshoot power supply problems and make correct repairs.

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Troubleshooting the Microcomputer	Related Knowledge		
	I. Power supply	Reading assignment	Ref. #19
	A. Switch	Pass out: Information Sheet	Information Sheet: teacher prepared
	1. Function		
	2. Problems	Show transparency	Transparency: teacher prepared
	B. Voltage		
	1. +5 V	Lecture and demonstrate:	
	2. +12 V	1. Measuring power supply output voltages and wave forms	Ref. #18, Appendix E, Troubleshooting
	3. -5 V		
	4. -12 V	2. Testing components	Ref. #20, pages 21-23
	C. Fuse and power transformer	3. Diagnostic procedure	Sams Computer facts for Apple II, II Plus and #CC-1
	1. Function	4. Troubleshooting charts	
	2. Fuse size	5. Checking fuse continuity	
	3. Problems		
	D. Reset circuit		
	1. Reset switch		
	2. Function		
	II. Dead power source	Review test equipment	
	A. Possible cause		
	B. Checks to be made		
	1. Switch		
	2. Reset		
	3. Voltage		
	4. Fuses		
	5. Components		
	Task Detail		
	Set up lab assignment as resources permit		

MAJOR BLOCK IX MICROCOMPUTER REPAIR	TASK: 4. Obtaining Replacement Parts AIM: The student will be able to properly determine parts to be replaced, identify the part from the schematic or service manual, write parts specifications and order or purchase the required part.		
MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Troubleshooting the Microcomputer	Related Knowledge I. Sources for parts A. Local computer store B. Wholesale houses C. Manufacturers D. Mail order catalogs E. Local electronic distributor F. Central electronic distributor II. Parts information A. Schematics B. Service manual C. Manufacturers' IC numbering system III. Ordering procedures A. Method B. Write specifications C. Parts warranty D. Problems 1. Time 2. Parts stock 3. Quantity IV. Purchasing procedures Task Detail Have students look up parts, parts number and cost from catalog and write specifications	Demonstrate and review 1. Parts catalogs 2. Manuals 3. Writing specifications 4. Looking up parts numbers 5. Cross-reference of numbers Discuss how parts are ordered through: 1. Dealers 2. Wholesale houses Review schematics and their use	Ref. #1, Appendix C Technical publications and catalogs of manufacturers: RCA, G.E., Motorola, Digikey Howard W. Sams, Inc. Apple Computers, Inc. Commador Business Machines

MAJOR BLOCK IX MICROCOMPUTER REPAIR	TASK: 1. Clean and Service Disk Operating System AIM: The student will be able to properly clean and service the disk operating system (DOS).		
MINOR BLOCK F	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Disk Operating System - Apple Computer	Related Knowledge		
	I. Function of the DOS	Reading assignment	Ref. #1, Chapter 8; Appendix E, Trouble-shooting Chart
	II. Disk drive mechanism A. Drive motor		
	B. Head carriage rails C. Spindle	Pass out: Information Sheet	Information Sheet: teacher prepared
	D. Clamping hub E. Index sector pickup	Show transparencies	Transparencies: teacher prepared
	F. Activity indicator G. Write-protect switch H. Index sector light source I. Head carriage J. Head load pad K. Head load arm	Discuss and review: 1. Purpose of preventive maintenance 2. Disk drive mechanisms 3. Cleaning chemicals 4. Cleaning safety	
	L. Head stepper M. Head N. Disk	5. Maintenance schedule 6. Lubrication Demonstrate: cleaning and servicing procedure	Apple Level I, Service Manual on Servicing D.O.S.
	III. Service problems A. Dirty head B. Faulty disk 1. Damaged 2. Dirty 3. Damaged by magnets C. Power supply D. Disk drive alignment		
	IV. Parts removal and replacement A. Cover B. Cable removal and replacement C. Analog card removal and replacement D. Collet hub removal and replacement E. Head load button	Demonstrate procedure Note: Emphasize importance of completeness, placement of replacement of parts	

MINOR BLOCK F	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Disk Operating System (continued)	Task Detail Set up lab assignment as resource permits		

MAJOR BLOCK IX

MICROCOMPUTER REPAIR

TASK: 2. Align and Adjust Disk Operating System

AIM: The student will be able to correctly align, adjust, and calibrate component of the disk operating system.

MINOR BLOCK F	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Disk Operating System - Apple Computer	Related Knowledge I. Alignment tools A. Exerciser disk B. Alignment disk C. Oscilloscope D. Diagnostics package E. Disk-fixer utility	Assigned reading	Ref. #1, Chapter 8: and Appendix E, "Trouble-shooting Chart" Apple Level I Technical Manual for the Apple DOS
	II. Alignment and adjustments A. Drive speed adjustment 1. Periodic check	Pass out: Information Sheet	Video tapes if available Information Sheet: teacher prepared
	2. Adjustment procedure	Show transparencies	Transparencies: teacher prepared
	3. Motor speed adjustment potentiometer or "Pot" B. Head radial alignment 1. Head position 2. Effects of misalignment 3. Equipment 4. Procedure 5. Scope trace C. Track zero sensor adjustment 1. Removal of cover 2. Microswitch 3. Equipment 4. Procedure D. Carriage stop adjustment 1. Function 2. Procedure 3. Carriage limiter test E. Index time adjustment 1. Function 2. Procedure F. Head load adjustment G. Raw data test and adjustment H. Collet hub adjustment I. Drive door adjustment	Emphasize importance of accurate adjustments and carefully study of instructions and procedures Demonstrate and explain: 1. DOS problems 2. Procedure for trouble-shooting 3. Precautions	

MINOR BLOCK F	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Disk Operating System (continued)	Related Knowledge (cont'.) J. Diskette stop guide ajustment K. Write protect switch adjustment III. Tests A. Amplitude B. Carriage limiter test C. Azimuth test Task Detail Set up lab assignment as resources permit		

MAJOR BLOCK IX
MICROCOMPUTER
REPAIR

TASK: 3. Troubleshoot and Repair Disk Operating System
AIM: The student will be able to identify common DOS problems, troubleshoot the system, and make necessary repairs.

MINOR BLOCK F	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Disk Operating System - Apple Computer	Related Knowledge		
	I. Clean and service DOS Refer to Major Block IX, Minor Block F, Task 1, "Clean and Service DOS"	Review cleaning and servicing procedures Assign reading Pass out: Information Sheet	Ref. #1, Chapter 8; Appendix E, "Troubleshooting Chart" Information Sheet: teacher prepared
	II. Disk operating system problems A. Intermittent read or write failure B. Drive operates, will not read C. Drive operates, will not write D. Interchange problem E. Drive will not operate F. Drive turns slowly, makes noise G. Disk will not move in or out H. Drive will not format disk I. Head will not step in or out J. Head oscillates at track 0 K. Head will not load	Demonstrate and explain: 1. Diagnosis of problem 2. Procedure for troubleshooting problems Show transparencies	Apple Level I Technical Manual and Video Tapes Transparencies: teacher prepared
	Task Detail Set up lab assignment as resources permit Note: Instructor may bug drive system and have students troubleshoot		

MAJOR BLOCK IX MICROCOMPUTER REPAIR	TASK: 1. Utilize Apple Level I Technical Manual and Video Tapes AIM: The student will be able to utilize the technical manual and video tapes in troubleshooting the microcomputer.		
MINOR BLOCK G	**INFORMATION & TASK DETAIL**	**SUGGESTIONS FOR TEACHING**	**REFERENCES & AIDS**
Diagnostic Procedures and Repair - Apple System	Related Knowledge		
	I. Technical manual	Assigned reading	Apple Level I Technical Manual and Video Tapes
	A. Research procedures		
	B. Schematic interpretation		
	C. Parts reference	Pass out: Information Sheet	Ref. #2, Chapter 2
	D. Troubleshooting procedures		Information Sheet: teacher prepared
	II. Video tapes		
	A. Selection	Show transparencies	Transparencies: teacher prepared
	B. Viewing procedure	Demonstrate and review procedures:	
	C. Handling procedure		
	III. Disassembly of computer	1. Use of manuals	
	A. Procedure	2. Tapes	
	B. Opening case	3. Disassembly procedure	
	C. Motherboard removal		
	D. Power light indicator replacement	Emphasize: 1. Handling tapes	
	E. Power supply removal	2. Handling printed circuit boards with chip mounted	
	F. Peripheral cards removal and replacement		
	Task Detail		
	Set up lab assignment as resources permit		

MAJOR BLOCK IX
MICROCOMPUTER
REPAIR

TASK: 2. Perform Diagnostic Test on Apple Computer
AIM: The student will be able to diagnose and repair computers by making effective use of technical manuals and video tapes.

MINOR BLOCK G	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Diagnostic Procedures and Repair - Apple System	Related Knowledge I. Introduction A. Level I technical manual B. Video tapes II. Memory tests A. Processor and ROM tests B. Random Access Memory (RAM) Test III. Keyboard test IV. Video test V. Loop ROM, RAM, and Processor test VI. Speaker test Task Detail Set up lab assignment according to technical manual and as resources permit	Reading assignments Note: Assigned from technical manuals and references Demonstrate and explain procedure for making tests Note: Lab assignment is based upon use of Apple Level I technical procedure manual, video tapes, and service procedures for the Apple II, II Plus, and IIe microcomputers	Apple Level I Technical Procedures Manual, #0720062 Ref. #19, Chapter 11 Ref. #18, Chapters 7, 10, and Appendix E Ref. #7, Buchbaum, Walter H., and Weissenberg, Gina, Microprocessor and Microcomputer Data Digest, Reston Publishing Co., Prentice-Hall Co., Reston, VA, Chapter 1

MAJOR BLOCK IX MICROCOMPUTER REPAIR	TASK: 3. Remove and Replace Apple IIe Keyboard AIM: The student will be able to troubleshoot, remove, and replace the keyboard on the Apple IIe computer.		
MINOR BLOCK G	**INFORMATION & TASK DETAIL**	**SUGGESTIONS FOR TEACHING**	**REFERENCES & AIDS**
Diagnostic Procedures and Repair - Apple System	Related Knowledge I. Troubleshoot procedures Refer to Major Block IX, Minor Block G, Tasks 1 and 2 II. Background differences A. Key switches B. Keyboard III. Keyboard A. Identification B. Removal C. Replacement IV. Module exchange service A. Location B. Replacement procedure C. Repair procedure D. Advantages E. Disadvantages Task Detail Set up lab assignment according to technical manual and as resources permit	Reading assignment Review previous lessons Refer students to technical manuals Pass out: Information Sheet Demonstrate and review: 1. Removal of keyboard 2. Procedure for replacement/ repair of keyboard	Apple Level I Service Manual #072-0062 Apple Service Programs Manual for Exchange Information Information Sheet: teacher prepared

MAJOR BLOCK IX

MICROCOMPUTER REPAIR

TASK: 4. Troubleshoot Apple Computers

AIM: The student will be able to apply the use of the Apple systems and flow chart in troubleshooting the Apple II, II Plus and IIe computer.

MINOR BLOCK G	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Diagnostic Procedures and Repair - Apple System	Related Knowledge I. System chart A. Apple II B. Apple II Plus C. Apple IIe II. Operational differences A. Apple II B. Apple II Plus C. Apple IIe III. Troubleshoot flow chart A. Application B. Apple IIc flow chart Task Detail Set up lab assignment according to troubleshoot procedure and as resources permit	Assigned reading: Troubleshooting Apple II, IIe computers Pass out: Information Sheet Demonstrate and explain use of manuals, and troubleing procedures	Ref. #20, Appendix B, "Apple Revisions" Ref. #18, Chapter 10, Appendix E Information Sheet: teacher prepared

MAJOR BLOCK X

ENTREPRENEURSHIP

TASK: 1. Principles of Free Enterprise System

AIM: The student will be able to define (describe) our economic system and compare it with other major economic systems. The student will further be able to explain the basis of our economy, list the primary factors of production, and identify the important groups in our economic system.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Free Enterprise	Related Knowledge		
	I. The rise of economic systems A. Dawn of civilization B. Discovery of tools C. Specialization/division of labor D. Industrialization E. Trade development	Reading assignment Discuss: History and background that gave rise to economic systems	Sup. Ref. L, Staff, An Introduction to Vocational Industrial Education, Vocational Instructional Services, Texas A&M University, F.E. Box 182, College Station, TX 77843
	II. Standard of living A. How well off people of a society are B. Synonymous with "economy" C. Measured by dividing total production by population	Define: standard of living; how it is measured	Sup. Ref. M, Fundamentals of The American Free Enterprise System, Hodgetts, R.M., and Smart, T.L., Addison-Wesley Publishing Co., Inc., Menlo Park, CA 94025
	III. Factors of production A. Land (resources) B. Labor (people) C. Capital (money invested) D. Technology (education; know-how)	Point out: factors of production	
	IV. Basic questions every economic system must answer A. What goods and services are to be produced? B. Who shall produce them? C. How shall they be produced? D. For whom shall they be produced?	List: on chalkboard	
	V. Basis of free enterprise A. Private property B. Private enterprise C. Freedom of choice	Expound: on each	

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Free Enterprise (continued)	Related Knowledge (cont'.) VI. Major types of economic systems today A. Pure capitalism B. Modified capitalism C. Socialism D. Communism	Lecture: major economic systems	
	VII. Pure capitalism A. Exists in theory only B. Individuals afforded liberties basic to free enterprise 1. People determine kinds of goods and services 2. No government control	Students take notes	
	VIII. Modified capitalism A. Laws regulate business activities to protect the people 1. Economic freedoms stated 2. Prevents monopolies B. Public determines product (supply and demand) C. Promotes finding better way (new products) D. Stress importance of individual 1. Occupational choice 2. Personal incentive 3. Private ownership E. Competition controls quality; price	Explain: laws protect the people; limited natural resources	
	IX. Socialism A. Government controls major industries 1. Transportation 2. Communication 3. Power and utilities	Compare: major economic systems	

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Free Enterprise (continued)	Related Knowledge (cont'.) B. Secondary industry permitted to remain in private ownership C. Secondary dependent on major: hence government controls 1. Prices 2. Wages		
	X. Communism A. Production of goods and services in hands of government 1. Government owns everything 2. Government decides all aspects of business and production 3. Private business nonexistent	Recite: Examples of "Have" and "Have Not" economies; reasons for	
	B. Promotes communism itself 1. No individual choice or freedom 2. No incentive; wastes individual talent 3. Stresses conformity; all rely on government	Emphasize: advantages of capitalistic economy	
	XI. Important groups in a capitalistic society A. Entrepreneurs - planners, organizers B. Managers - overseers C. Workers - produce goods/services	Explore: part each plays; how they are interdependent	
	D. Consumers - utilize goods/services	Review: questions/answers	

MAJOR BLOCK X

ENTREPRENEURSHIP

TASK: 2. Identify Various Forms of Business Ownership

AIM: The student will be able to identify and describe the different forms of business ownership actively engaged within the free enterprise system.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Free Enterprise	Related Knowledge		
	I. Sole proprietorship A. Owned and controlled by one individual B. Most common form of business ownership in America (75%)	Reading assignment	Sup. Ref. M
	C. Mostly small-medium sized D. Advantages 1. Fewer restrictions on starting/terminating venture 2. Sole decision maker 3. Easier to manage 4. All profits belong to owner		Sup. Ref. N, Wright R. Thomas, Manufacturing Material Processing, Management, Careers, The Goodheart-Willcox Co., Inc., Homewood, IL 60430
	5. Simpler tax structure 6. Higher credit standing II. Partnerships A. General partners 1. Have equal and unlimited liability 2. All partners active in firms' operation	Students take notes	
	B. Limited partners 1. One dominant partner assumes unlimited liability; is the decision maker 2. Others limit liability to amount to money they invest	Recite: examples of each form in the community; state	

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Free Enterprise (continued)	Related Knowledge (cont'.) C. Silent partner 1. Known as a partner 2. Takes no active part in management D. Nominal partner 1. Lends name to venture 2. Makes no investment nor assists in operation E. Advantages of partnership 1. Increased source of capital and credit 2. Improved decision making potential 3. Better possibilities for expansion and growth III. Joint venture A. Partnership created for particular purpose B. Partnership dissolved when objective is accomplished C. Advantages 1. Increases power of bidding and acquiring contracts 2. Increases power to fulfill contracts IV. Syndicates A. Resemble both general partnership and joint venture B. Organize to conduct financial transactions C. Advantages 1. Increases buying power 2. Beneficial to small business with mutual needs		

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Free Enterprise (continued)	Related Knowledge (cont'.) V. Unincorporated associations A. Most often used by non-profit organizations B. Exist to provide services to members C. Annual dues; fees levied membership for financing D. Examples 1. Credit associations 2. Fraternal organizations 3. Charities VI. Corporations A. Usually outgrowth of other forms of ownership B. Largest of all forms of ownership C. Multi-owners called stockholders D. Regarded as an artificial being with 1. Right to enter contracts 2. Conduct business in own name E. Must file for and receive corporate charter to do business F. Charter defines: 1. Type of business 2. Number of shares of stock 3. Basis of corporate structure G. Corporate organization 1. Stockholders (owners) 2. Board of directors (policy makers)		

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Free Enterprise	Related Knowledge (cont'.)		
(continued)	3. President (head)		
	4. Corporate officers (division heads)		
	5. Managers		
	6. Supervisors		
	7. Workers		
	H. Advantages	Guest speaker: "Free Enterprise"	Guest speaker: civic leader
	1. Indefinite life		
	2. Limited liability		
	3. Ease of ownership transfer		
	4. Growth potential		
	5. Managerial efficiency	Questions and answer session	
	Task Detail		
	1. Design a questionnaire in preparation of interviewing owners of local businesses		
	2. Select and interview a local business owner		
	3. Compare results of interviews in class		

MAJOR BLOCK X ENTREPRENEURSHIP	TASK: 3. Entrepreneurship and Computer Technology AIM: The student will be able to describe entrepreneurship; identify many risks and responsibilities in starting a business; and weigh the advantages/disadvantages of business ownership.		
MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Free Enterprise	Related Knowledge		
	I. Facts about entrepreneurship in U.S.	Reading assignment	Sup. Ref. O
	A. One of every eight persons on labor force is self-employed	Explain: role small business plays in American economy	
	B. 10.8 million of country's 88 million labor force are single owner small businesses		
	C. 87% of total business operations are small	Place: statistics on chalkboard	
	1. Over 10 million have annual sales under $100,000.00		
	2. 7½ million single-owner businesses show receipts less than $25,000		
	II. Personal traits characteristic entrepreneurs	Have students reflect on qualities admired in their employer	Sup. Ref. P, "Development of Professional Attitudes", Vocational Instructional Services, Texas A&M University, F.E. Box 182, College Station, TX 77843 Sup. Ref. Q, *Starting Your Own Marketing Business*, 2nd Ed., Ely and Barnes, McGraw-Hill Book Co., 2121 Ave. of Americas, New York, NY 10020
	A. Passion to achieve		
	1. Pride of achievement		
	2. Leave personal, lasting mark		
	3. Make name for self		
	4. Aspire to fame		
	B. Urge to be boss		
	1. Independence motivation stronger than security		
	2. Desire to plot own course		
	C. Self-confidence		
	1. Expects and desires role of decision maker		

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Free Enterprise (continued)	Related Knowledge (cont.) 2. Delights in facing problems and making decisions D. Energy (physical stamina) E. Determination		
	F. Versatility and adaptability III. Advantages of entrepreneurship A. Fills important basic needs to 1. Achieve 2. Meet challenge; make decisions	Class discussion: advantages; disadvantages (instructor guide discussion)	
	3. Demonstrate creativity; individuality B. Opportunity to develop close relationship with 1. Customers 2. Employees C. Pride and prestige of ownership D. Unlimited financial growth potential	List: advantages/disadvantages on chalkboard	
	IV. Disadvantages of entrepreneurship A. Long work hours B. Risk of financial loss C. Burdens often heavy on family D. Contend with confines of regulatory agencies	Guest speaker	Guest speaker: local electronic shop owner or computer service owner
	V. Necessary skills of the entrepreneur A. Ability to plan - set goals B. Ability to organize - means of attaining goals C. Ability to control - cause people to do things productively	Discuss: necessary skills of an entrepreneur	

MINOR BLOCK	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Free Enterprise	Related Knowledge (cont'.)		
(continued)	VI. Role of electronic technician	Explain: role in today's economy	
	A. Industry 1. Computer assisted design (CAD) 2. Computer assisted manufacturing (CAM) 3. Robots 4. Quality control 5. Others B. Communications C. Office systems D. Education E. Medicine F. Aerospace G. General public 1. Sales 2. Installations 3. Repair service		

MAJOR BLOCK X

ENTREPRENEURSHIP

TASK: 1. Business Potential

AIM: The student will be able to identify and discuss many of the elements involved in investigating and planning a prospective business.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Business	Related Knowledge		
	I. Elements of entrepreneurship A. Planning-setting goals B. Organizing-structuring	Reading assignment	Sup. Ref. M
	C. Controlling-directing II. Determine product and market A. Define product service B. Evaluate business potential 1. Present 2. Future C. Establish limits extent of business	Lecture: procedures for investigating a potential business	Sup. Ref. Q
	III. Identify essentials for production A. Equipment B. Materials C. Facility D. Skills	Discuss: essentials for production	
	IV. Estimate financial needs A. Capital outlay 1. Building 2. Equipment 3. Materials B. Operating capital 1. Overhead 2. Payroll C. Cash-flow considerations 1. Outflow-capital output, inventory, salaries 2. Inflow-payment of goods and services	List: on chalkboard criteria for estimating financial needs	

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Business	Related Knowledge (cont'.)		
(continued)	V. Starting part-time A. Advantages 1. Provides practical experience 2. Useful in building up trade; reputation 3. Little overhead; less financial risk 4. Allows more competitive pricing	Guest speaker: "Getting started in business"	Guest speaker: local electronic shop owner or computer service owner
	B. Disadvantages 1. Long hours 2. May affect regular job competency	Question and answer session	
	3. May compete with employer	Review	

MAJOR BLOCK X

ENTREPRENEURSHIP

TASK: 2. Loans, Finance, and Credit

AIM: The student will be able to define secured and unsecured loan, collateral and lines of credit. The student will also be capable of properly wiring a personal check and balancing a personal checking account.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Business	Related Knowledge		
	I. Types of loans	Reading assignment	Sup. Ref. Q
	A. Unsecured loans		
	1. Promissory note		
	2. Called signature loan		
	3. Requires no collateral	Define: unsecured loan, secured loan	
	B. Secured loan		
	1. Formally written		
	2. Specifies terms;		
	II. Sources of loans	List: sources of loans	
	A. Personal savings		
	B. Family; friends		
	C. Banks; trust companies		
	D. Credit unions		
	E. Government		
	III. Forms of collateral	Define: collateral	
	A. Real estate	List: examples	
	B. Insurance policies		
	C. Pledge company assets		
	IV. Lines of credit	Discuss: credit; importance of "good credit"; honesty; integrity	
	A. Personal reputation		
	1. Honesty		
	2. Integrity		
	B. Credit ratings		
	1. Better Business Bureau		
	2. Banks		
	3. Charge accounts		
	V. Terms and interest	Explain: simple interest compound interest, principal, unpaid balance	
	A. Terms - condition of loan		
	1. Amount of loan		
	2. Length of loan		

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Business (continued)	Related Knowledge (cont'.)		
	3. Interest rate charged		
	4. How loan is to be repaid		
	5. Guarantees		
	B. Interest - charge for loan	Illustrate: on chalkboard	
	1. Simple		
	2. Compound		
	3. Principal		
	4. Unpaid balance		
	VI. Banking		
	A. Accounts	Guest speaker: "Personal Banking"	Guest speaker: local banker
	1. Checking account		
	2. Passbook savings		
	3. Certificates of saving		
	B. Balancing books		
	1. Deposits		
	2. Withdrawals		
	3. Service charges		
	C. Writing checks	Review	

MAJOR BLOCK X ENTREPRENEURSHIP	TASK: 1. Cost Estimating AIM: The student will be able to explain the methods by which electronic shop owners arrive at prices for contract proposals. The student will further be able to make simple quantity takeoff in preparation of such a proposal.		
MINOR BLOCK C	**INFORMATION & TASK DETAIL**	**SUGGESTIONS FOR TEACHING**	**REFERENCES & AIDS**
Production	Related Knowledge		
	I. Definition A. A means used to evaluate B. To fix a cost in an aproximate manner II. Purpose A. Establish an accurate aproximate cost before production B. Usually for the purpose of bidding on and obtaining contracts	Lecture: purpose; importance of good estimating	Sup. Ref. R, Entrepreneurship - The Art of Business Ownership, Vocational Instructional Services, Texas A&M University, F.E. Box 182, College Station, TX 77843
	III. Other uses of good estimating A. Material take-off used to order material as needed B. Time estimates for preparing job schedules	List: on chalkboard	
	C. Schedules forecast: 1. Number of workers 2. Skills required 3. Where and when special equipment needed 4. Material delivery at site	Students take notes	
	IV. Traits of a good estimator A. Meticulous 1. Observant 2. Persistent B. Neat and orderly 1. Detailed 2. Progressive	Discuss: qualities, prerequisites	

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Production (continued)	Related Knowledge (cont'.)		
	V. Prerequisites of a good estimator A. Ability to visualize: 1. Finished product 2. Steps necessary in performing job 3. Number of workers, skills, time required 4. Equipment and materials needed 5. Hidden items such as permits, bonds, taxes	Guest speaker: "Cost estimating"	Guest speaker
	B. Read and interpret schematics and specifications 1. Dimension 2. Symbols	Review: schematic reading	
	C. Mathematical ability 1. Computational skills 2. Tabulation accuracy	Review: related math	
	D. Knowledge of materials and prices		
	1. Types of components and their uses 2. Prices of components 3. Availability	Dealer's catalogs	
	E. Experience in the field which he/she is estimating 1. Skills necessary 2. Procedures, techniques currently used 3. Time required 4. Special equipment necessary		
	VI. Major phases of estimating A. Component take-off		

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Production (continued)	Related Knowledge (cont'.) 1. Type 2. Quantity 3. Unit; total price B. Labor pricing 1. Number of technicians 2. Skills required 3. Work hours (time)		
	VII. Types of cost estimating A. Volume method 1. Some components sold by volume 2. Some contracts based on volume	Explain: methods of cost estimating; how methods vary according to job	
	3. Based on unit cost to supply/move construct B. Guesstimate 1. Based on personal experience 2. Usually in a local, well-known area 3. Usually small jobs/contracts on regular basis	Recite: examples	
	C. Detailed quantity take-off 1. Detailed item by item breakdown of a. Components b. Time	Pass out: Assignment Sheet	Assignment Sheet: teacher prepared drawings and specifications
	2. Cost analysis of hidden items not clearly evident in plans and specifications a. Permits and bonds b. Special equipment machines c. Operating overhead	Emphasize: importance of identifying hidden cost	

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Production	Related Knowledge (cont'.)		
(continued)	3. Most used type building and construction	Point Out: this method most used in the electronics business	
	D. Unit cost estimate 1. Prototype developed 2. Cost analysis made 3. Standard units produced		

MAJOR BLOCK X

ENTREPRENEURSHIP

TASK: 2. Contracts

AIM: The student will be able to list the ingredients of a contract and explain what constitutes a valid contract, invalid contract, and breach of contract.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Production	Related Knowledge		
	I. The American Legal System	Lecture	Sup. Ref. M
	A. Constitution basis		
	1. Defines laws "rules of the game" within which individuals; businesses must operate	Discuss: history and background of the American Legal System	
	2. Establishes system by which these laws are governed		
	B. Two main sources of law	Describe: the two main sources of law in the United States	
	1. Statutory law (written law) enactments of government		
	2. Common law (unwritten law) based on court decisions		
	II. Nature of business law	Explain: the nature of business law in the United States	
	A. Provides orderly conduct of business affairs		
	B. Provides settlement of any disputes arising from these affairs		
	C. Contract law is one of the most important areas of business law	Guest speaker: "Contracts"	Guest speaker: city attorney, lawyer
	D. Everyone, every business, enters into contracts of some sort	Question and answer session	
	III. Ingredients of a contract	List: ingredients of a contract	
	A. Voluntary agreement		
	1. There must be an offer		
	2. Offer must be accepted		

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Production (continued)	Related Knowledge (cont'.) 3. Agreement must be voluntary		
	B. Competent parties 1. Parties to agreement must be legally qualified 2. Insane persons, convicts, drunkards, minors are not regarded legally qualified	Define: legally competent, consideration, lawful act	
	C. Consideration 1. Must be present for contract to be binding 2. Consideration is something of value received by one party or given up by another D. Lawful act-within the law	Present: examples to the class for discussion	
	IV. Forms of a contract A. Verbal 1. Parties simply agree among themselves as to terms, conditions 2. Verbal contracts generally will not hold up in a court of law	Discuss: forms of a contract	
	B. Written 1. Spells out all terms and considerations 2. Agreement signed and witnessed	Pass Out: sample contract	Pass Out: teacher prepared
	V. Types of contracts A. Fixed B. Cost plus fixed fee		
	C. Cost plus percentage of cost D. Index E. General conditions F. Specifications	Explain: each type contract	

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Production	Related Knowledge (cont'.)		
(continued)	VI. Contract format	Discussion of terms	
	A. Cover		
	B. Bid forms		
	C. Instructions to bidder		
	D. Index		
	E. General conditions		
	F. Specifications		
	VII. Clauses to avoid	Analyze: contract specifications	
	VIII. Breach of contract		
	A. Failure of one party to honor all terms of agreements	Explain: breach of contract; possible results	
	B. Grounds for lawsuit		
	1. Plantiff - person instituting lawsuit		
	2. Defendant - person against whom action is brought		
	IX. Penalties	Point Out: value of cost estimating	
	A. Damages and delays		
	B. Performance bonds		
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MAJOR BLOCK X ENTREPRENEURSHIP	TASK: 1. Hiring AIM: The student will be able to prepare a personal resume and write an appropriate letter of application. The student will be able to list and knowledgeably discuss commonly used practices and procedures in recruiting and hiring personnel.		
MINOR BLOCK D	**INFORMATION & TASK DETAIL**	**SUGGESTIONS FOR TEACHING**	**REFERENCES & AIDS**
Personnel	Related Knowledge		
	I. Major practices in hiring personnel	Reading assignment	Sup. Ref. R
	A. Recruitment - finding and atrracting potential employees		
	B. Selection - screening to find best qualified	Lecture practices in hiring	
	C. Induction - program designed to make new employees feel they belong		
	II. Techniques of recruitment	List techniques of recruitment	
	A. Advertisement		
	1. By word-of-mouth		
	2. On-the-site-advertisement		
	3. Newspaper and trade journals		
	B. School and college placement centers		
	C. Employment agencies		
	1. Public		
	2. Private		
	D. Trade unions		
	III. Selection processes		
	A. Letters of application	Pass out: Sample letter of application	
	1. Contents		
	2. Organization		
	B. Application forms	Discuss: contents, organization	
	1. Includes personal data	Students write letter	
	2. Provides reference	Pass out sample application form	
	3. Reveals work experience		

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Personnel (continued)	Related Knowledge (cont'.) C. Resumes, dossiers, and portfolios 1. Perform similar function as application form 2. May include sample of applicant's work; especially engineering, drafting D. Tests 1. Proficiency tests - measure existing ability 2. Aptitude tests - measure ability to learn E. Personal interview 1. Generally considered most important part of hiring process	Discuss with class	
	2. Allows person hiring to judge intangibles (value judgements) a. Optimism b. Sincerity c. Whether applicant will fit into family of employees 3. Gives applicant opportuity to ask about the job; the company IV. Induction procedure A. Designed to make new employee feel he/she belongs	Point out intangible items best judged via personal confrontation	
	B. Program, informal or formal, provides employee with: 1. Company history; its products	List items on chalkboard	

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Personnel (continued)	Related Knowledge (cont'.)		
	2. Employee benefits; services		
	3. Employee duties; work rules; practices		
	4. Company structure; opportunities for advancement; importance of each job to whole operation	Encourage class participation	
	V. Holding personnel		
	A. Employer-employee relations	Discuss employer-employee relations	
	1. Fairness		
	2. Dignity of individuals		
	3. Mutual respect		
	B. Work conditions	Students prepare questions for mock interviews	
	1. Environment (physical conditions)		
	2. Safety		
	a. Equipment		
	b. Procedures		
	C. Salaries; wages		
	D. Incentives (fringe benefits)	Mock interviews of classmates before class	
	1. Sick leave		
	2. Vacations		
	3. Insurance plans	Class critique	

MAJOR BLOCK X

ENTREPRENEURSHIP

TASK: 2. Internal Relations

AIM: The student will be able to list many personal qualities employers seek in potential employees and reasons for each. The student will further be able to describe conditions of employment desirable by potential employees and reasons for such.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Personnel	Related Knowledge		
	I. Company organization	Reading assignment	Sup. Ref. R
	A. How structured		
	1. Divisions/departments	Lecture: supplement with chalkboard illustrations	
	2. Positions/jobs		
	B. Duties and responsibilities		
	1. Span of control		
	2. Limits of responsibility		
	II. Policies and procedures		
	III. Lines of authority	Discuss: lines of authority, line-staff relations	
	A. Levels at which orders are given		
	B. Levels at which advice is given		
	IV. Line-staff relations	Oral questions	
	A. Cause for reprimands		
	1. Doing something he/she shouldn't		
	2. Not doing something he/she should		
	B. Causes for dismissal		
	1. Attitudes		
	2. Inefficiency		
	V. Employee-employer relations	Brainstorming session by class	
	A. What employer can expect from employees	List on chalkboard	
	1. Dependability		
	a. Work hours		
	b. Work standards		
	c. Company policies		
	2. Productivity	Recite examples of each	
	a. Efficient use of time		

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Personnel (continued)	Related Knowledge (cont'.)		
	b. Work attitudes		
	c. Cooperation		
	3. Loyalty		
	a. Become part of the organization		
	b. Support and improve organization		
	4. Harmony		
	a. Honesty		
	b. Work with others		
	B. What employees can expect from employer	List on chalkboard	
	1. Organization		
	a. Planning		
	b. Conducting		
	2. Communication	Discuss each as listed	
	a. What? Where? When?		
	b. Communication, two ways		
	3. Appreciation		
	a. Policies fair, consistent		
	b. Incentives		
	c. Recognition		
	C. Security		
	a. Training		
	b. Advancement		
	c. Retirement		
	VI. Employee-employer relations		
	A. Professional respect		
	1. Work attitudes		
	2. Cooperation		
	3. Job maturity		
	B. Social respect		
	1. Others' property	Review	
	2. Dignity of individuals		
	3. Social amenities		

MAJOR BLOCK X

ENTREPRENEURSHIP

TASK: 3. Public Relations

AIM: The student will be able to explain the concept of public relations, the purpose of public relations, and the need for good public relations.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Personnel	Related Knowledge		
	I. Definitions A. Public opinion B. Communication specialists C. Public relations	Reading assignment	Sup. Ref. R
	II. Purpose of public relations A. Promote company's product/service B. Develop a degree of knowledge about product C. Establish policy of goodwill	Explain purpose and intent	
	III. Need for public relations A. Inform the public B. Influence public opinion C. Interpret public wants		
	IV. Principles of public relations A. Listening - to public opinion B. Analyzing - objectives of company C. Planning - programs of communication D. Implementing - program to stimulate desired public attitude	List principles	
	V. Day-by-day practice of public relations A. Business community 1. Reputation 2. 3. Product quality B. Civic community 1. Contribuiton to community	Discuss day-by-day practices	

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Personnel	Related Knowledge (cont'.)		
(continued)	2. Involvement in community C. Advertising 1. Advertising 2. Techniques	Guest speaker public relation	Speaker: P.R. Specialist

APPENDIX

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DEVELOPING A FUNCTIONAL COURSE OF STUDY

The vocational industrial teacher should carefully study the objectives of the local school, the objectives of vocational industrial education and the content that should be included in the vocational industrial course of study. The teacher should then select the content and write behavorial objectives which will have a definite relationship to the course. Each objective should be analyzed as to the activity which can be provided to promote its development. The objectives are then accepted or rejected on the basis of facilities available to place the activity into operation. (See Appendix page 230 for a partial list of items that may be used in developing specific objectives for the development of abilities, attitudes and appreciations.)

When selecting the course content for a functional course of study, the vocational industrial teacher should carefully consider each of the following:

1. Provide for the development of skills in all basic processes inherent in the occupation involved.
2. Provide student experiences in the interpretation and use of fundamental factual information basic to the occupation and to the success of the student.
3. Provide experiences in related science, mathematics, blueprint reading and shop sketching and other subjects or topics related to the occupation.
4. Provide learning experiences regarding hazards, benefits, joys, and sorrows connected with a chosen occupation.
5. Provide experiences which will enable students to take their place in life and fulfill their life's needs as an an enlightened citizen and worker.
6. Provide learning experiences whereby students are enabled to see their prospective occupation in relationship to management, labor and the professions.

PROFESSIONAL SERVICES

Texas local school administrators and local school supervisors may obtain the services of area consultants, vocational industrial teacher educators and vocational industrial personnel of Vocational Industrial Services to assist the teacher with the development of the complete course of study. This professional service is available on written request to the Associate Commissioner for Occupational Education, Texas Education Agency, Austin, Texas 78711.

A SUGGESTED LIST OF ITEMS THAT SHOULD BE INCLUDED IN WRITING SPECIFIC OBJECTIVES FOR THE DEVELOPMENT OF ABILITIES, DESIRABLE ATTITUDES, AND APPRECIATIONS

Related technical information
Basic manipulative tasks
Good work habits
Good safety habits
Problem solving
Administering first aid
Make working sketches
Make good use of library
Ability to communicate
Ability to talk effectively
Leadership skills
Reading skills
Understand everyday science
The value of other courses
Basic economics, business & management
State & national issues, related to occupation
Keeping up to date
Civic needs of the community
Adapt to changes in technology
Relate work to manpower situation
Pride in a job well done
Live harmoniously with others
Broad aspects of work-trends-factors
Professional trade associations
Goals of vocational & technical education
Social Security and benefits
Free enterprise system
Techniques of job application
Recognize hazards and remove them
True meaning of loyalty to trade and to self
Open-minded and receptive to change
A sense of balance and proportion
A high quality of workmanship
Needs of others
A willingness to do more than minimum
Workmanship having recognized value
Respect for authority
Rise above failure
Overcome boredom
Value of time
Speak up in defense of principles
A willingness to accept assignment
Reliability-dependability to deliver
Value of experience
Value of speed in production
Value of the tools of the trade
Clean-safe work areas
Ability to plan work effectively
Employee-employer relations
Understand the democratic society
Individual initiative and responsibility
Values of moral conduct and ethical living
Our standard of living
Important people in this field
Mass production
Legislation (related)
History of the industry
Conservation
Listening effectively

ACTIVITIES SHOULD BE PROVIDED TO PROMOTE THE DEVELOPMENT OF EACH ITEM

METHODS OF TEACHING

METHOD	DESCRIPTION	ADVANTAGES	DISADVANTAGES	WHEN TO USE
1. LECTURE	Transferring information verbally. An explanation of the teaching points of each topic	Ability to handle large groups Ability to utilize radio Easy to provide facilities	Limits type of subjects Limits chance to learn Liable to confuse learner Can't measure efficiency	To impart new information To supplement other methods
2. ILLUSTRATION	Use of pictures, charts, maps, sketches, models, films, chalkboard	Brings out hidden features Learn by seeing Good substitution for demonstration Cheaper than demonstration	Sometimes hard to get Doesn't always teach what you want Eliminates teaching for doing ability	Profitable supplement to any other method As a substitute for demonstration
3. DEMONSTRATION	Actually doing the job step by step, explaining the how and why of each step	Builds confidence in instructor Proves information reliable More nearly affords complete learning	Lack of suitable place Lack of suitable equipment Excessive cost Takes time Limits size of class	Instructing for doing ability To supplement other methods
4. CONFERENCE	Drawing information from group and through discussion arrive at conclusion	Uses group experience Brings out best point of experience for new ideas Every man has chance	Experience of group Lack of trained leaders Conference may get out of control Takes a lot of time	Instructing for improved practices To reach conclusions Supplement to other methods
5. QUESTIONS & ANSWERS	Key questions planned by instructor on subject matter of lesson --tie-in with other lessons -- review of previous lesson -- application of lesson	To promote thinking To review Emphasize key points To promote individual participation Helps in developing understanding	Requires time and thought on part of instructor to select and frame good questions Sometimes used to kill time May allow some students to do all the talking if not properly directed	To review & tie-in preceding lesson Before concluding a lesson to review and emphasize major points To bring in experience of class members use with all methods

METHOD	DESCRIPTION	ADVANTAGES	DISADVANTAGES	WHEN TO USE
6. PRACTICE	If skill is to be developed Learner practices performance of skill under close supervision	Develops performance skill	Danger of improper supervision	After instructor demonstrates a doing job the learner should always practice doing the job under supervision of the instructor
7. DRILL	If information is to be understood Learner reviews and repeats main points of information or problem solving until he has it mastered and understands it.	Helps master and retain points of information	Danger of improper supervision	After the instructor has presented an informational lesson with proper teaching aids and explanation, the opportunity to discuss, review or use the information is provided